Insulin Delivery Service

Bluetooth® **Service Specification**

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- **Prepared By:** Medical Devices Working Group

Abstract:

This service exposes the control capability, the status of an Insulin Delivery Device (IDD) running an insulin infusion therapy, and historical therapy data to be used in the personal and professional healthcare industry.

Version History

Version Number	Date	Comments
v1.0	2018-07-24	Adopted by the Bluetooth SIG Board of Directors.
v1.0.1	2022-01-18	Adopted by the Bluetooth SIG Board of Directors.
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1 Introduction

The Insulin Delivery Service (IDS) exposes the control capability and the status of an Insulin Delivery Device running an insulin infusion therapy. The user needs to know the current status of the insulin therapy whenever the user does something that may influence their insulin need. A Collector device usually provides status information (e.g., a status screen on a graphical user interface (UI)) to support the user of an Insulin Delivery Device with the latest information. The control capability enables the support of the insulin therapy by adapting therapy parameters (e.g., the basal rate profile) and allows the remote operation of the insulin therapy as well as the remote operation for device maintenance (e.g., priming).

This document is not intended to specify the Client or Server application, but it specifies the protocol for the data exchange between those applications. The Insulin Delivery Service provides the means for that. Therefore, the description of the behavior of the Client and Server is limited to the protocol level. The behavior on the application level shall be specified separately by vendors of Insulin Delivery Devices and is implementation specific.

1.1   Conformance

Each capability of this specification shall be supported in the specified manner. This specification may provide options for design flexibility, because, for example, some products do not implement every portion of the specification. For each implementation option that is supported, it shall be supported as specified.

1.2   Change History

This section summarizes changes at a moderate level of detail and should not be considered representative of every change made.

1.2.1   Changes from v1.0 to v1.0.1

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Table 1.2: Errata incorporated in v1.0.2

1.3   Language

1.3.1   Language conventions

The Bluetooth SIG has established the following conventions for use of the words *shall*, *must*, *will*, *should*, *may*, *can*, *is*, and *note* in the development of specifications:

shall	<u>is required to</u> – used to define requirements.
must	<u>is a natural consequence of</u> – used only to describe unavoidable situations.
will	<u>it is true that</u> – only used in statements of fact.
should	<u>is recommended that</u> – used to indicate that among several possibilities one is recommended as particularly suitable, but not required.
may	<u>is permitted to</u> – used to allow options.
can	<u>is able to</u> – used to relate statements in a causal manner.
is	<u>is defined as</u> – used to further explain elements that are previously required or allowed.
note	Used to indicate text that is included for informational purposes only and is not required in order to implement the specification. Each note is clearly designated as a "Note" and set off in a separate paragraph.

For clarity of the definition of those terms, see Core Specification Volume 1, Part E, Section 1.

1.3.2   Reserved for Future Use

Where a field in a packet, Protocol Data Unit (PDU), or other data structure is described as "Reserved for Future Use" (irrespective of whether in uppercase or lowercase), the device creating the structure shall set its value to zero unless otherwise specified. Any device receiving or interpreting the structure shall ignore that field; in particular, it shall not reject the structure because of the value of the field.

Where a field, parameter, or other variable object can take a range of values, and some values are described as "Reserved for Future Use," a device sending the object shall not set the object to those values. A device receiving an object with such a value should reject it, and any data structure containing it, as being erroneous; however, this does not apply in a context where the object is described as being ignored or it is specified to ignore unrecognized values.

When a field value is a bit field, unassigned bits can be marked as Reserved for Future Use and shall be set to 0. Implementations that receive a message that contains a Reserved for Future Use bit that is set to 1 shall process the message as if that bit was set to 0, except where specified otherwise.

The acronym RFU is equivalent to Reserved for Future Use.

1.3.3   Prohibited

When a field value is an enumeration, unassigned values can be marked as "Prohibited." These values shall never be used by an implementation, and any message received that includes a Prohibited value shall be ignored and shall not be processed and shall not be responded to.

Where a field, parameter, or other variable object can take a range of values, and some values are described as "Prohibited," devices shall not set the object to any of those Prohibited values. A device receiving an object with such a value should reject it, and any data structure containing it, as being erroneous.

"Prohibited" is never abbreviated.

1.4   Service dependencies

This service is not dependent upon any other services.

1.5   GATT sub-procedure requirements

Requirements in this section represent a minimum set of requirements for an Insulin Delivery Device (Server). Other GATT sub-procedures may be used if supported by both Client and Server.

Table 1.3 below summarizes additional GATT sub-procedure requirements beyond those required by all GATT Servers.

GATT Sub-Procedure	Requirements
Write Characteristic Values	M
Notifications	M
Indications	M
Read Characteristic Descriptors	M
Write Characteristic Descriptors	M

Table 1.3: Additional GATT sub-procedure requirements

1.6   Transport dependencies

This service shall operate over LE transport only.

1.7   Byte transmission order

All characteristic values used with this service shall be transmitted with the least significant octet first (i.e., little endian). The least significant octet is identified in the characteristic definitions in [6].

1.8   Application error codes

This service defines the following Attribute Protocol Application Error codes:

Name	Error Code	Description
Invalid CRC	0x81	If E2E-Protection is supported and a Write procedure is processed with wrong Cyclic Redundancy Check (CRC) value attached.
Invalid Counter	0x82	If E2E-Protection is supported and a Write procedure is processed with an invalid Counter (invalid if missing or equal or less than the last value).

Table 1.4: Attribute Protocol Application Error codes defined by this service

1.9　E2E-Protection

Some portions of the communication path between the Sensor and Collector could include devices or software that do not have data integrity and data unambiguity between the Sensor and Collector Applications outside the Bluetooth data transfer. (e.g., a Bluetooth dongle connected via USB). If data integrity and data unambiguity is needed, a system called E2E-Protection may be necessary. E2E-Protection system uses a count of messages and a CRC of messages to facilitate data integrity and data unambiguity. If the Server supports E2E-Protection, all characteristics shall contain an E2E-CRC field and / or E2E-Counter field. The order of these fields and the presence of the E2E-Counter field are described in each characteristic section. See Section 3.1 for details about the E2E-Counter field and E2E-CRC field.

See Section 3.12 for the Server behavior in case of End-to-End (E2E) errors.

2 Service

The Insulin Delivery Service should be instantiated as a «Primary Service».

The service UUID shall be set to the UUID value assigned to Insulin Delivery Service as defined in [2].

3 Service characteristics

The characteristic requirements in an instance of the Insulin Delivery Service are shown in Table 3.1. Unless otherwise specified, only one instance of each characteristic is permitted within this service.

Characteristic Name	Require ment	Mandatory Properties	Optional Properties	Security Permissions	Section
IDD Status Changed	M	Read, Indicate		Authorization required	3.2
IDD Status	M	Read, Indicate		Authorization required	3.3
IDD Annunciation Status	M	Read, Indicate		Authorization required	3.4
IDD Features	M	Read	Indicate C.3	Authorization required	3.5
IDD Status Reader Control Point	M	Write, Indicate		Authorization required	3.6
IDD Command Control Point	O	Write, Indicate		Authorization required	3.7
IDD Command Data	C.1	Notify		Authorization required	3.8
IDD Record Access Control Point	O	Write, Indicate		Authorization required	3.9
IDD History Data	C.2	Notify		Authorization required	3.10

Table 3.1: Insulin Delivery Service characteristics

C.1:   Mandatory if the optional IDD Command Control Point is included, otherwise excluded.
C.2:   Mandatory if the optional IDD Record Access Control Point is included, otherwise excluded.
C.3:   The Indicate property shall be supported for the IDD Features characteristic if the value of the IDD Features characteristic can change over the lifetime of the device, otherwise Excluded for this service.

Note 1: Properties not listed as Mandatory or Optional are Excluded.
Note 2: Where a characteristic can be indicated and/or notified, a Client Characteristic Configuration descriptor shall be included in that characteristic as required by the Core Specification [1]. In that case, the Client Characteristic Configuration descriptor shall have the same security permissions as the characteristic.

3.1 Common characteristic fields

The following sections describe characteristic fields that are included in all characteristics of this Service depending on the supported features as exposed by the IDD Features characteristic (see Section 3.5).

3.1.1 E2E-Counter field

If the Server supports E2E-Protection (i.e., the *E2E-Protection Supported* bit is set in the Flags field of the IDD Features characteristic, see Section 3.5), an E2E-Counter field shall be included in all characteristics except the IDD History Data characteristic (see also Section 3.10.4.5).

The E2E-Counter field, when used correctly, provides that messages are received in the correct order. This field contains its own uint8 counter. There are two different types of E2E-Counter values that can be included within the E2E-Counter field: a transmit E2E-Counter value that is sent by the Server and a received E2E-Counter value from the Client.

The Server shall increment the transmit E2E-Counter value of a characteristic with each read response, indication, and notification of that characteristic. In addition, the Server shall increment the transmit E2E-Counter value of a control point with each indicated response to an executed control point procedure.

The transmit E2E-Counter value for each characteristic on both the Server and Client shall start with a value of 1 at the beginning of each connection and shall have a maximum value of 255. If this upper limit is reached during the connection, the transmit E2E-Counter value shall roll over to 1 again with the next increment.

In addition, each increment of a transmit E2E-Counter value shall be a step of 1 such that both the Server and Client can check the validity of a received E2E-Counter value in a reliable manner, especially after a rollover has occurred. A transmit E2E-Counter value of 0 shall be skipped because it simplifies the implementation of the check if the last message reached the maximum value of 255.

The Server shall maintain the last received E2E-Counter value for each control point characteristic to check that any newly received E2E-Counter value for that characteristic was increased since the last write request of the Client. The received E2E-Counter value for each characteristic shall be initialized to a value of 255 at the beginning of each connection (i.e., 255 is the previous valid received E2E-Counter value, because the first received E2E-Counter value at the beginning of each connection is 1).

See Section 3.15 for details how an out of sequence message can be detected by checking the received E2E-Counter value.

3.1.2 E2E-CRC field

If the Server supports E2E-Protection, all fields of a characteristic shall be secured by a CRC calculated over all fields of the characteristic payload, including the E2E-Counter field, except for the E2E-CRC field itself. See Section 3.15 for details.

The IDD History Data characteristic does not include an E2E-Counter field, and therefore it is not part of the E2E-CRC calculation.

3.2   IDD Status Changed

The IDD Status Changed characteristic is composed of status changes of the insulin therapy and the Insulin Delivery Device.

It is left to the implementation of the Server Application when status changes related to an insulin delivery (Reservoir Remaining Amount, Total Daily Insulin Status) are triggered. For example, basal insulin is delivered within a time block (defined by the basal rate profile), but depending on the specific implementation, the actual delivery may be distributed over several points in time within that block to provide a continuous basal insulin flow.

The Server shall retain the status of a bit of the Flags field until its value is reset by the Collector (i.e., by executing procedure Reset Status, see Section 3.6.2.1).

3.2.1   Characteristic behavior

3.2.1.1   Flags field

The Flags field shall be included in the IDD Status Changed characteristics.

The Flags field indicates status changes of the insulin therapy and the Insulin Delivery Device.

Reserved for Future Use (RFU) bits in the Flags field shall be set to 0.

3.2.1.2   E2E-Counter field and E2E-CRC field (optional)

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field followed by an E2E-CRC field shall be included in the IDD Status Changed characteristic.

3.2.1.3   Mapping of IDD Status Changed Flags to Status Value characteristics and CP procedures

The following characteristics or control points can be accessed to get status values corresponding to the bits of the Flags field of the IDD Status Changed characteristic:

- IDD Status (see Section 3.3)

- IDD Annunciation Status (see Section 3.4)

- IDD Status Reader Control Point (see Section 3.6)

- IDD Record Access Control Point (see Section 3.9)

If an IDD Status Changed Flags field indicates a change in at least one of the bits, the Server shall provide the new information in the corresponding characteristic or response of a control point procedure:

3.2.1.3.1 Mapping to IDD status

The Server shall provide new status values in the IDD Status characteristic as signaled by the bits of the IDD Status Changed Flags field according to Table 3.2:

IDD Status Changed Flags Bit	Fields of IDD Status Characteristic
Therapy Control State Changed	Therapy Control State
Operational State Changed	Operational State
Reservoir Status Changed	Reservoir Remaining Amount

Table 3.2: Mapping of IDD Status Changed Flags to IDD Status characteristic

3.2.1.3.2 Mapping to IDD Annunciation status

The Server shall provide new status values in the IDD Annunciation Status characteristic as signaled by the bits of the IDD Status Changed Flags field according to Table 3.3:

IDD Status Changed Flags Bit	Fields of IDD Annunciation Status Characteristic
Annunciation Status Changed	Annunciation Instance ID Annunciation Type Annunciation Status AuxInfo Fields

Table 3.3: Mapping of IDD Status Changed Flags to IDD Annunciation Status characteristic

3.2.1.3.3 Mapping to IDD Status Reader CP Procedures

The Server shall provide new status values by the IDD Status Reader CP procedures as signaled by the bits of the IDD Status Changed Flags field according to Table 3.4. For details about the Operands of the Op Code responses, see Section 3.6.1.

IDD Status Changed Flags Bit	IDD Status Reader CP Procedure
Total Daily Insulin Status Changed	Get Total Daily Insulin Status Get Delivered Insulin
Active Basal Rate Status Changed	Get Active Basal Rate Delivery Get Delivered Insulin
Active Bolus Status Changed	Get Active Bolus IDs Get Active Bolus Delivery Get Delivered Insulin

Table 3.4: Mapping of IDD Status Changed Flags to IDD Status Reader CP procedures

3.2.1.3.4 Mapping to IDD Record Access Control Point (RACP) Procedures

The Server shall provide new status values by the IDD RACP procedures as signaled by the bits of the IDD Status Changed Flags field according to Table 3.5. For details about the Operands of the Op Code responses, see Section 3.9.3.

Flags Bit Name	IDD Record Access Control Point Procedure
History Event Recorded	Report Stored Records Report Number of Stored Records

Table 3.5: Mapping of IDD Status Changed Flags to IDD RACP procedures

3.3   IDD Status

The IDD Status characteristic is composed of status values of the Insulin Delivery Device and the insulin therapy.

3.3.1   Characteristic behavior

3.3.1.1   Therapy Control State field

The Therapy Control State field shall be included in the IDD Status characteristics.

The Therapy Control State field describes the therapy state of the insulin delivery (e.g., stop, pause, run).

3.3.1.2   Operational State field

The Operational State field shall be included in the IDD Status characteristics.

The Operational State field represents the operational state of the Insulin Delivery Device in the context of running an insulin infusion therapy (e.g., priming).

3.3.1.3   Reservoir Remaining Amount field

The Reservoir Remaining Amount field shall be included in the IDD Status characteristics.

The Reservoir Remaining Amount field represents the remaining amount of insulin in the reservoir in IU. If the Reservoir is not attached (i.e., *Reservoir Attached* bit of Flags field is set to *False*), the Reservoir Remaining Amount shall be set to *NaN*.

The update frequency of the Reservoir Remaining Amount field is left to the implementation.

3.3.1.4   Flags field

The Flags field shall be included in the IDD Status characteristics.

The Flags field exposes status bits of the Insulin Delivery Device (e.g., Reservoir Attached bit).

Reserved for Future Use (RFU) bits in the Flags field shall be set to 0.

3.3.1.5   E2E-Counter field and E2E-CRC field (optional)

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field followed by an E2E-CRC field shall be included in the IDD Status characteristic.

3.4   IDD Annunciation Status

The IDD Annunciation Status characteristic is a variable length structure comprising of messages that describe state changes of the Insulin Delivery Device and in the therapy relevant functions. The IDD

Annunciation Status characteristic shall provide the active annunciation (i.e., any unconfirmed) as determined by the Server Application (e.g., with highest priority). If there is no unconfirmed annunciation or there has not been an annunciation yet, bit 0 of the Flags field shall be set to 0 (i.e., no subsequent fields are attached).

3.4.1 Characteristic behavior

3.4.1.1 Flags field

The Flags field shall be included in the IDD Annunciation Status characteristics.

Reserved for Future Use (RFU) bits in the Flags field shall be set to 0.

The Flags field indicates the presence of the annunciation and optional AuxInfo fields in the IDD Annunciation Status record.

3.4.1.2 Annunciation Instance ID field

If the *Annunciation Present* bit of the Flags field is set to 1, the Annunciation Instance ID field shall be included in the IDD Annunciation Status characteristics.

The Annunciation Instance ID field is a unique identifier created by the Server application for all annunciations that occur in the course of time.

3.4.1.3 Annunciation Type field

If the *Annunciation Present* bit of the Flags field is set to 1, the Annunciation Type field shall be included in the IDD Annunciation Status characteristics.

This Annunciation Type field describes the kind of annunciation in the scope of the Server application.

3.4.1.4 Annunciation Status field

If the *Annunciation Present* bit of the Flags field is set to 1, the Annunciation Status field shall be included in the IDD Annunciation Status characteristics.

This Annunciation Status field represents the current status of an annunciation.

3.4.1.5 AuxInfo fields

The AuxInfo fields shall be included in the IDD Annunciation Status characteristics if they are indicated by the Flags field.

The AuxInfo fields describe details of an annunciation (e.g., to display additional information to the user). The underlying data and data format of these fields are defined by the Server Application. See Section Appendix A for different examples of how these fields could be used by the manufacturer of an Insulin Delivery Device.

3.4.1.6 Mandatory Use of AuxInfo fields in context of temperature annunciation type

If the IDD Annunciation Status characteristic exposes an annunciation of type *Temperature* or the Server records such an annunciation in the history, the following requirements apply to the fields AuxInfo1 - AuxInfo4 of the IDD Annunciation Status characteristic and accordingly of the Annunciation Status Changed Part 1 of 2 and Annunciation Status Changed Part 2 of 2 events:

LSO ↓						
	Requirement	**Meaning**	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
AuxInfo1	M	Value	SFLOAT	2	As specified by bit 0 of Temperature Flags	LSO… MSO
AuxInfo2	M	Temperature Flags	8 bit	1	None	LSO… MSO
		Context	Enumeration of uint8	1	None	
AuxInfo3	O[1]	Lower Bound	SFLOAT	2	As specified by bit 0 of Temperature Flags	LSO… MSO
AuxInfo4	O[1]	Upper Bound	SFLOAT	2	As specified by bit 0 of Temperature Flags	LSO… MSO
MSO ↑						

Table 3.6: Mandatory use of AuxInfo fields in context of annunciation type temperature

[1] This field is optional, but if it is attached, it shall be indicated via Flags field.

3.4.1.6.1 AuxInfo1 Value field

The AuxInfo1 field shall contain the value of the temperature in the unit specified by bit 0 of the Temperature Flags field inside the AuxInfo2 field.

3.4.1.6.2   AuxInfo2 Temperature Flags field

The first octet of the AuxInfo2 field shall contain a Temperature Flags field:

Bit	Definition	Description
0	Unit	If this bit is set, the unit is Celsius; otherwise Fahrenheit.
6	Status Too Low	If this bit is set, the temperature is less than the lower bound.
7	Status Too High	If this bit is set, the temperature is greater than the upper bound.
All other bits	RFU	None

Table 3.7: AuxInfo2 Temperature Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

If the temperature is considered to be in range, both bits Status Too Low and Status to High shall not be set.

3.4.1.6.3   AuxInfo2 Context field

The second octet of the AuxInfo2 field shall contain a Context field.

3.4.1.6.4   AuxInfo2 Context values

The following values are defined for the AuxInfo2 Context field:

Description	Value	Meaning
Generic Device	0x0F	The reported temperature refers to the Insulin Delivery Device in general.
Insulin	0x33	The reported temperature refers to the insulin delivered by the Insulin Delivery Device in general (e.g., the insulin in the reservoir).
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 3.8: AuxInfo2 Context values

3.4.1.6.5   AuxInfo3 Lower Bound field

The AuxInfo3 field shall contain the value of the lower bound of the temperature. The unit shall be specified by bit 0 of the Temperature Flags field inside the AuxInfo2 field.

3.4.1.6.6 AuxInfo4 Upper Bound field

The AuxInfo4 field shall contain the value of the upper bound of the temperature. The unit shall be specified by bit 0 of the Temperature Flags field inside the AuxInfo2 field.

3.4.1.7 E2E-Counter field and E2E-CRC field (optional)

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field followed by an E2E-CRC field shall be included in the IDD Annunciation Status characteristic.

3.5 IDD Features

The IDD Features characteristic shall be used to describe the supported features of the Server.

The value of the IDD Features characteristic shall be static during a connection.

3.5.1 Characteristic behavior

When read or indicated, the IDD Features characteristic gives a value that is used by a Client to determine the supported features of the Server.

When the Client Characteristic Configuration descriptor is configured for indications and the supported features of the Server have changed, the IDD Features characteristic shall be indicated to any bonded Collectors after reconnection.

3.5.1.1 E2E-CRC field and E2E-Counter field

An E2E-CRC field followed by an E2E-Counter field shall be added at the beginning of the IDD Features characteristic even if the Server does not implement E2E-Protection. This allows a future extension with new feature bits of the Flags field of IDD Features.

If the Server does not support E2E-Protection (*E2E-Protection Supported* bit is not set in Flags field of IDD Features), the E2E-CRC field shall be set to *0xFFFF* and the E2E-Counter shall be set to 0.

3.5.1.2 Insulin Concentration field

The Insulin Concentration field shall be included in the IDD Features characteristic to expose the intended insulin concentration of the Insulin Delivery Device in IU/mL.

3.5.1.3 Flags field

The Flags field shall be included in the IDD Features characteristics.

If the corresponding feature is supported, the Supported Feature bit shall be set to 1, otherwise it shall be set to 0. This applies to the following features:

- E2E-Protection: If supported, the *E2E-Protection Supported* bit shall be set to 1, otherwise it shall be set to 0. If E2E-Protection is supported, all characteristics (i.e., not just the IDD Features characteristic) shall contain an E2E-CRC field and / or E2E-Counter field (see Sections 3.1.1 and 3.1.2).

- Basal Rate: If supported, the *Basal Rate Supported* bit shall be set to 1, otherwise it shall be set to 0. If the Server supports the Basal Rate feature, it shall also support templates of basal rate profiles.

- Temporary Basal Rate (TBR) Absolute: If supported, the *TBR Absolute Supported* bit shall be set to 1, otherwise it shall be set to 0.

- TBR Relative: If supported, the TBR Relative Supported bit shall be set to 1, otherwise it shall be set to 0.

- TBR Template: If supported, the *TBR Template Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Fast Bolus: If supported, the *Fast Bolus Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Extended Bolus: If supported, the *Extended Bolus Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Multiwave Bolus: If supported, the *Multiwave Bolus Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Bolus Delay Time: If supported, the *Bolus Delay Time Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Bolus Template: If supported, the *Bolus Template Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Bolus Activation Type: If supported, the *Bolus Activation Type Supported* bit shall be set to 1, otherwise it shall be set to 0.

- Multiple Bond: If supported, the *Multiple Bond Supported* bit shall be set to 1, otherwise it shall be set to 0.

- (Insulin Sensitivity Factor) ISF Profile Template: If supported, the *ISF Profile Template Supported* bit shall be set to 1, otherwise it shall be set to 0. If the Server supports the ISF Profile Template feature, a specific ISF Profile Template can be considered in the calculation of a bolus calculator of the Server or Client Application.

- Insulin-to-Carbohydrate (I2CHO) Ratio Profile Template: If supported, the *I2CHO Ratio Profile Template Supported* bit shall be set to 1, otherwise it shall be set to 0. If the Server supports the I2CHO Ratio Profile Template feature, a specific Insulin-to-Carbohydrate (I:CHO) Ratio Profile Template can be considered in the calculation of a bolus calculator of the Server or Client Application.

- Target Glucose Range Profile Template: If supported, the *Target Glucose Range Profile Template Supported* bit shall be set to 1, otherwise it shall be set to 0. If the Server supports the Target Glucose Range Profile Template feature, a specific Target Glucose Range Profile Template can be considered in the calculation of a bolus calculator of the Server or Client Application.

- Insulin On Board (IOB): If supported, the *Insulin On Board Supported* bit shall be set to 1, otherwise it shall be set to 0. If the Server supports the Insulin On Board feature, the IOB can be considered in the calculation of a bolus calculator of the Server or Client Application.

Reserved for Future Use (RFU) bits in the Flags field shall be set to 0.

The *Feature Extension* bit shall be set to 0.

If the *Feature Extension* bit is required to be set to 1 in a future version of this Service, an additional octet is attached (bits 24 … 31), where bit 31 will be used as *Feature Extension* bit in the same way. If this bit is set, then another octet is attached (bits 32 … 39) and so on. This is defined to allow future extension of the characteristic.

3.6   IDD Status Reader Control Point

The IDD Status Reader Control Point provides insulin therapy relevant status information (e.g., currently running boluses or current basal rate).

The Server shall confirm the end of an executed procedure by indicating the IDD Status Reader Control Point.

3.6.1   IDD Status Reader Control Point procedure requirements

The table below shows the requirements for the IDD Status Reader Control Point procedures concerning the request Op Codes and Operands in the context of this service:

Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Reset Status	3.6.2.1	M	Flags as defined in characteristic IDD Status Changed	M
Get Active Bolus IDs	3.6.2.2	C.1	N/A	N/A
Get Active Bolus Delivery	3.6.2.3	C.1	1. Bolus ID 2. Bolus Value Selection	M
Get Active Basal Rate Delivery	3.6.2.4	C.2	N/A	N/A
Get Total Daily Insulin Status	3.6.2.5	M	N/A	N/A
Get Counter	3.6.2.6	O	• Counter Type • Counter Value Selection	M
Get Delivered Insulin	3.6.2.7	O	N/A	N/A
Get Insulin On Board	3.6.2.8	C.5	N/A	N/A
Responses				
Op Code	**Procedure Section**	**Op Code Requirement**	**Operand**	**Operand Requirement**
Response Code	N/A	M	• Request Op Code • Response Code Value	M

Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Get Active Bolus IDs Response	3.6.2.2	C.1	Active Bolus IDs record: • Number of Active Boluses • Bolus ID1 • Bolus ID2 • Bolus ID3 • Bolus ID4 • Bolus ID5 • Bolus ID6 • Bolus ID7	M
Get Active Bolus Delivery Response	3.6.2.3	C.1	Active Bolus Delivery record: • Flags • Bolus ID • Bolus Type • Bolus Fast Amount • Bolus Extended Amount • Bolus Duration • Bolus Delay Time • Bolus Template Number • Bolus Activation Type	M
Get Active Basal Rate Delivery Response	3.6.2.4	C.2	Active Basal Rate Delivery record: • Flags • Active Basal Rate Profile Template Number • Active Basal Rate Current Config Value • TBR Type • TBR Adjustment Value • TBR Duration Programmed • TBR Duration Remaining • TBR Template Number • Basal Delivery Context	M

Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Get Total Daily Insulin Status Response	3.6.2.5	M	Total Daily Insulin Status record: • Total Daily Insulin Sum of Bolus Delivered • Total Daily Insulin Sum of Basal Delivered • Total Daily Insulin Sum of Bolus and Basal Delivered	M
Get Counter Response	3.6.2.6	C.3	Counter record: • Counter Type • Counter Value Selection • Counter Value	M
Get Delivered Insulin Response	3.6.2.7	C.4	Delivered Insulin record: • Bolus Amount Delivered • Basal Amount Delivered	M
Get Insulin On Board Response	3.6.2.8	C.5	Insulin On Board record: • Flags • Insulin On Board • Remaining Duration	M

Table 3.9: IDD Status Reader CP Procedure Requirements for Requests

C.1: Mandatory if the Insulin Delivery Device supports boluses (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.
C.2: Mandatory if the Insulin Delivery Device supports a basal rate (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.
C.3: Mandatory if optional Op Code Get Counter is included, otherwise excluded.
C.4: Mandatory if optional Op Code Get Delivered Insulin is included, otherwise excluded.
C.5: Mandatory if the Insulin Delivery Device supports insulin on board (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

3.6.2 IDD Status Reader Control Point behavioral description

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field followed by an E2E-CRC field shall be included in the IDD Status Reader Control Point characteristic.

If E2E-Protection is supported, the Server shall check the E2E-Counter and E2E-CRC and handle errors as defined in Section 3.12.

3.6.2.1 Reset Status procedure

If the *Reset Status* Op Code is written to the IDD Status Reader Control Point with an Operand containing a Flags field, the Server shall reset the status exposed by the IDD Status Changed characteristic. If a bit

of the Flags Operand is set to 1, the corresponding status shall be reset (any change to the Flags field of the IDD Status Changed characteristic may be indicated if a Client configured it for indications). If the bit is set to 0, the status shall be retained. The Server shall confirm the status reset by indicating the IDD Status Reader Control Point with a *Response Code* Op Code, a *Request Op Code* of Reset Status and *Response Code Value* of *Success*.

If the operation results in an error condition, this shall be indicated using *Response Code* Op Code, *Request Op Code* of Reset Status, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.2   Get Active Bolus IDs procedure

If the *Get Active Bolus IDs* Op Code is written to the IDD Status Reader Control Point, the Server Application shall determine the IDs of the currently Active Boluses and the Server shall indicate the IDD Status Reader Control Point with a *Get Active Bolus IDs Response* Op Code and an Active Bolus IDs record. The Bolus ID fields shall be set in chronological order by their start date time of the delivery (i.e., the point time at which the bolus was set plus the Bolus Delay Time, see Section 3.7.2.12.) So, the Bolus ID1 field shall contain the ID of the oldest Active Bolus and Bolus ID7 shall contain the ID of the most current Active Bolus.

Due to the default MTU size, the Server can only send seven IDs of Active Boluses in the response. If there are more than seven Active Boluses at the same time, the Server shall send the seven Bolus IDs with the oldest start date time of the delivery. However, this is assumed as an exceptional case.

If the operation results in an error condition, this shall be indicated using *Response Code* Op Code, *Request Op Code* of Get Active Bolus IDs, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.3   Get Active Bolus Delivery procedure

If the *Get Active Bolus Delivery* Op Code is written to the IDD Status Reader Control Point with an Operand containing a Bolus ID and a Bolus Value Selection field, the Server shall look up the corresponding Active Bolus and indicate the IDD Status Reader Control Point with a *Get Active Bolus Delivery Response* Op Code and an Active Bolus Delivery record.

The Server shall indicate the IDD Status Reader Control Point with a *Response Code* Op Code, a *Request Op Code* of Get Active Bolus Delivery and *Response Code Value* in the Operand set to *Procedure not applicable* in the following cases:

- The Operand that was sent with a *Get Active Bolus Delivery* Op Code specifies a Bolus ID of a bolus, which is not an Active Bolus.

- The Operand that was sent with a *Get Active Bolus Delivery* Op Code specifies a Bolus ID of a bolus, which does not exist (i.e., the Server Application has never assigned that Bolus ID to a set bolus).

If the Bolus Value Selection Operand is set to an RFU value, the Server shall indicate the IDD Status Reader Control Point with a *Response Code* Op Code, a *Request Op Code* of Get Active Bolus Delivery, and a *Response Code Value* in the Operand set to *Invalid Operand*.

If the Bolus Value Selection Operand is set to *Delivered* and the Bolus Delay Time field is present (i.e., *Bolus Delay Time Present* bit is set in Flags field), the Server shall set the Bolus Delay Time field to *0xFFFF* to signal that the Bolus Delay Time is not applicable with that Bolus Value Selection Operand.

If the Bolus Type within the Active Bolus Delivery record is set to "Fast", the Server shall set the Bolus Duration and the Bolus Extended Amount to 0.

If the Bolus Type within the Active Bolus Delivery record is set to "Extended", the Server shall set the Bolus Fast Amount to 0.

If the operation results in an error condition, this shall be indicated using *Response Code* Op Code, *Request Op Code* of Get Active Bolus Delivery, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.4 Get Active Basal Rate Delivery procedure

If the *Get Active Basal Rate Delivery* Op Code is written to the IDD Status Reader Control Point, the Server shall indicate the IDD Status Reader Control Point with a *Get Active Basal Rate Delivery Response* Op Code and an Active Basal Rate Delivery record.

If there is no currently active basal rate, the Server shall indicate the IDD Status Reader Control Point with a *Response Code* Op Code, a *Request Op Code* of Get Active Basal Rate Delivery, and a *Response Code Value* in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using *Response Code* Op Code, *Request Op Code* of Get Active Basal Rate Delivery, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.5 Get Total Daily Insulin Status procedure

If the *Get Total Daily Insulin Status* Op Code is written to the IDD Status Reader Control Point, the Server shall indicate the IDD Status Reader Control Point with a *Get Total Daily Insulin Status Response* Op Code and a Total Daily Insulin Status record.

The Total Daily Insulin Status record contains the total daily delivered bolus and basal insulin from midnight until now based on the current date time of the Server (i.e., if the date time is changed, the insulin amounts always refer to the current date time).

If the Insulin Delivery Device does not support boluses, the Server shall set the Total Daily Insulin Sum of Bolus Delivered field to 0. If the Insulin Delivery Device does not support a basal rate, the Server shall set the Total Daily Insulin Sum of Basal Delivered field to 0 (see IDD Features Flags in Section 3.5.1.3).

If the operation results in an error condition, this shall be indicated using *Response Code* Op Code, *Request Op Code* of Get Total Daily Insulin Status, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.6 Get Counter procedure

If the *Get Counter* Op Code is written to the IDD Status Reader Control Point with an Operand containing a Counter Type and Counter Value Selection field, the Server shall indicate the IDD Status Reader Control Point with a *Get Counter Response* Op Code and a Counter record.

The Server shall indicate the IDD Status Reader Control Point with a *Response Code* Op Code, a *Request Op Code* of Get Counter, and a *Response Code Value* in the Operand set to *Invalid Operand* in the following cases:

- The Counter Type is set to an RFU value or is not supported by the Server.

- The Counter Value Selection for the Counter Type is set to a RFU value, or is not supported by the Server.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Counter, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.7 Get Delivered Insulin procedure

If the *Get Delivered Insulin* Op Code is written to the IDD Status Reader Control Point, the Server shall indicate the IDD Status Reader Control Point with a *Get Delivered Insulin Response* Op Code and a Delivered Insulin record.

If the Bolus Amount Delivered field or Basal Amount Delivered field exceeds the value of 80,000.00 IU, the Server shall roll over this value to 0.

The underlying data type of FLOAT for these amounts has an upper limit of 83,886.07 if a precision of two decimal places is required. In a worst case scenario, it is assumed that 200 IU can be delivered per day, which means that this limit is reached in 419 days. The value of 80,000.00 is chosen to provide a convenient implementation.

It is left to the implementation of the Server Application if the delivered bolus insulin amount (exposed by the Bolus Amount Delivered field) is updated at the end or during the bolus delivery. For example, the delivered bolus amount could be updated after the delivery of the fast part of a multiwave bolus and a second time after the delivery of the extended part, or not until the complete delivery of the extended part.

If a bolus is canceled for any reason, the effective delivered insulin amount is included in the calculation of the Bolus Amount Delivered field.

The update frequency of the delivered basal insulin amount (exposed by the Basal Amount Delivered field) is left to the implementation of the Server Application (e.g., at the end of a basal rate time block and with each TBR).

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Delivered Insulin, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.6.2.8 Get Insulin On Board procedure

If the *Get Insulin On Board* Op Code is written to the IDD Status Reader Control Point, the Server shall indicate the IDD Status Reader Control Point with a *Get Insulin On Board Response* Op Code and an Insulin On Board record.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Insulin On Board, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7 IDD Command Control Point

The IDD Command Control Point provides procedures to support the insulin therapy by adapting therapy parameters to operate the insulin therapy remotely and to perform a remote operation of the device maintenance.

If a procedure is executed on the IDD Command Control Point which requires more than one response from the Server to get the requested information (e.g., Read Basal Rate Profile Template), the Server shall send the responses by notifications of the IDD Command Data characteristic and shall indicate the IDD Command Control Point to confirm the end of the executed procedure.

3.7.1 IDD Command Control Point procedure requirements

The table below shows the requirements for the IDD Command Control Point procedures concerning the request Op Codes and Operands in the context of this service:

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Device State	Set Therapy Control State	3.7.2.2	M	Therapy Control State	M
Device State	Set Flight Mode	3.7.2.3	M	N/A	N/A
Annunciations	Snooze Annunciation	3.7.2.4	M	Annunciation Instance ID	M
Annunciations	Confirm Annunciation	3.7.2.5	M	Annunciation Instance ID	M
Basal Rate	Read Basal Rate Profile Template	3.7.2.6	C.1	Basal Rate Profile Template Number	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Write Basal Rate Profile Template	3.7.2.7	C.1	Basal Rate Profile Template record: • Flags • Basal Rate Profile Template Number • First Time Block Number Index • First Duration • First Rate • Second Duration • Second Rate • Third Duration • Third Rate	M
Temporary Basal Rate	Set TBR Adjustment	3.7.2.8	C.2	TBR record: • Flags • TBR Type • TBR Adjustment Value • TBR Duration • TBR Template Number • TBR Delivery Context	M
	Cancel TBR Adjustment	3.7.2.9	C.2	N/A	N/A
	Get TBR Template	3.7.2.10	C.3	TBR Template Number	M
	Set TBR Template	3.7.2.11	C.3	TBR Template record: • TBR Template Number • TBR Type • TBR Adjustment Value • TBR Duration	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Bolus	Set Bolus	3.7.2.12	C.4	Bolus record: • Flags • Bolus Type • Bolus Fast Amount • Bolus Extended Amount • Bolus Duration • Bolus Delay Time • Bolus Template Number • Bolus Activation Type	M
	Cancel Bolus	3.7.2.13	C.4	Bolus ID	M
	Get Available Boluses	3.7.2.14	C.4	N/A	N/A
	Get Bolus Template	3.7.2.15	C.5	Bolus Template Number	M
	Set Bolus Template	3.7.2.16	C.5	Bolus Template record: • Bolus Template Number • Flags • Bolus Type • Bolus Fast Amount • Bolus Extended Amount • Bolus Duration • Bolus Delay Time	M
	Get Max Bolus Amount	3.7.2.31	O	N/A	N/A
	Set Max Bolus Amount	3.7.2.32	O	Max Bolus Amount	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Template Handling	Get Template Status and Details	3.7.2.17	C.6	N/A	N/A
	Reset Template Status	3.7.2.18	C.6	• Number of Templates to Reset • Template Numbers	M
	Activate Profile Templates	3.7.2.19	C.7	• Number of Profile Templates to Activate • Profile Template Numbers	M
	Get Activated Profile Templates	3.7.2.20	C.7	N/A	N/A
Device Maintenance	Start Priming	3.7.2.21	O	Amount	M
	Stop Priming	3.7.2.22	C.8	N/A	N/A
	Set Initial Reservoir Fill Level	3.7.2.23	O	Fill Level	M
	Reset Reservoir Insulin Operation Time	3.7.2.24	O	N/A	N/A
ISF Profile	Read ISF Profile Template	3.7.2.25	C.9	ISF Profile Template Number	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Write ISF Profile Template	3.7.2.26	C.9	ISF Profile Template record: • Flags • ISF Profile Template Number • First Time Block Number Index • First Duration • First ISF • Second Duration • Second ISF • Third Duration • Third ISF	M
I:CHO Ratio Profile Template	Read I2CHO Ratio Profile Template	3.7.2.27	C.10	I2CHO Ratio Profile Template Number	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Write I2CHO Ratio Profile Template	3.7.2.28	C.10	I2CHO Ratio Profile Template record: • Flags • I2CHO Ratio Profile Template Number • First Time Block Number Index • First Duration • First I2CHO Ratio • Second Duration • Second I2CHO Ratio • Third Duration • Third I2CHO Ratio	M
Target Glucose Range Profile Template	Read Target Glucose Range Profile Template	3.7.2.29	C.11	Target Glucose Range Profile Template Number	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Write Target Glucose Range Profile Template	3.7.2.30	C.11	Target Glucose Range Profile Template record: • Flags • Target Glucose Range Profile Template Number • First Time Block Number Index • First Duration • First Lower Target Glucose Limit • First Upper Target Glucose Limit • Second Duration • Second Lower Target Glucose Limit • Second Upper Target Glucose Limit	M
Responses					
N/A	Response Code	N/A	M	• Request Op Code • Response Code Value	M
Annunciations	Snooze Annunciation Response	3.7.2.4	M	Annunciation Instance ID	M
	Confirm Annunciation Response	3.7.2.5	M	Annunciation Instance ID	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
Basal Rate Profile Template	Read Basal Rate Profile Template Response[1]	3.7.2.6	C.1	N/A	N/A
	Write Basal Rate Profile Template Response	3.7.2.7	C.1	• Flags • Basal Rate Profile Template Number • First Time Block Number Index	M
Temporary Basal Rate	Get TBR Template Response	3.7.2.10	C.3	TBR Template record: • TBR Template Number • TBR Type • TBR Adjustment Value • TBR Duration	M
	Set TBR Template Response	3.7.2.11	C.3	TBR Template Number	M
Bolus	Set Bolus Response	3.7.2.12	C.4	Bolus ID	M
	Cancel Bolus Response	3.7.2.13	C.4	Bolus ID	M
	Get Available Boluses Response	3.7.2.14	C.4	Flags	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Get Bolus Template Response	3.7.2.15	C.5	Bolus Template record: • Bolus Template Number • Flags • Bolus Type • Bolus Fast Amount • Bolus Extended Amount • Bolus Duration • Bolus Delay Time	M
	Set Bolus Template Response	3.7.2.16	C.5	Bolus Template Number	M
	Get Max Bolus Amount Response	3.7.2.31	C.12	Max Bolus Amount	N/A
Template Handling	Get Template Status and Details Response[1]	3.7.2.17	C.6	Template status and details record: • Template Type • Starting Template Number • Number of Templates • Max Number of Supported Time Blocks • Configurable and Configured Flags	M
	Reset Template Status Response	3.7.2.18	C.6	• Number of Templates Reset • Template Numbers	M
	Activate Profile Templates Response	3.7.2.19	C.7	• Number of Profile Templates Activated • Profile Template Numbers	M

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Get Activated Profile Templates Response	3.7.2.20	C.7	• Number of Activated Profile Templates • Profile Template Numbers	M
ISF Profile Template	Read ISF Profile Template Response[1]	3.7.2.25	C.9	N/A	N/A
	Write ISF Profile Template Response	3.7.2.26	C.9	• Flags • ISF Profile Template Number • First Time Block Number Index	M
I:CHO Ratio Profile Template	Read I2CHO Ratio Profile Template Response[1]	3.7.2.27	C.10	N/A	N/A
	Write I2CHO Ratio Profile Template Response	3.7.2.28	C.10	• Flags • I2CHO Ratio Profile Template Number • First Time Block Number Index	M
Target Glucose Range Profile Template	Read Target Glucose Range Profile Template Response[1]	3.7.2.29	C.11	N/A	N/A

Category	Op Code	Procedure Section	Op Code Requirement	Operand	Operand Requirement
	Write Target Glucose Range Profile Template Response	3.7.2.30	C.11	• Flags • Target Glucose Range Profile Template Number • First Time Block Number Index	M

Table 3.10: IDD Command CP Procedure Requirements for Requests

C.1: Mandatory if the Insulin Delivery Device supports basal rate profile templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.2: Mandatory if the Insulin Delivery Device supports TBRs (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.3: Mandatory if the Insulin Delivery Device supports TBR templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.4: Mandatory if the Insulin Delivery Device supports boluses (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.5: Mandatory if the Insulin Delivery Device supports bolus templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.6: Mandatory if the Insulin Delivery Device supports any of the following features: basal rate profile templates, TBR templates, bolus templates, ISF profile templates, I:CHO ratio profile templates, target glucose range profile templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.7: Mandatory if the Insulin Delivery Device supports any of the following features: basal rate profile templates, ISF profile templates, I:CHO ratio profile templates, target glucose range profile templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.8: Mandatory if optional procedure "Start Priming" is implemented, otherwise excluded.

C.9: Mandatory if the Insulin Delivery Device supports ISF profile templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.10: Mandatory if the Insulin Delivery Device supports I:CHO ratio profile templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.11: Mandatory if the Insulin Delivery Device supports target glucose range profile templates (see IDD Features Flags in Section 3.5.1.3), otherwise excluded.

C.12: Mandatory if optional procedure "Get Max Bolus Amount" is implemented, otherwise excluded.

[1] This Op Code is not used in the context of the IDD Command CP, but instead is used in the context of the IDD Command Data characteristic. The Server sends one or more response records by notifications of the IDD Command Data characteristic and sets the Response Op Code field of IDD Command Data characteristic to this Op Code. For details, see the referenced procedure section and Section 3.8.1.3 for Response Op Code Specific Operands, and see Section B.1 for an example.

3.7.2 IDD Command Control Point behavioral description

If the Insulin Delivery Device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field followed by an E2E-CRC field shall be included in the IDD Command Control Point characteristic.

If E2E-Protection is supported, the Server shall check the E2E-Counter and E2E-CRC and handle errors as defined in Section 3.12.

3.7.2.1 Common Profile Template Procedures behavioral description

This section defines the common behavior and error conditions of procedures to read and write a profile template. A profile template can be a template of the following profile types:

- Basal Rate Profile

- ISF Profile

- I:CHO Ratio Profile

- Target Glucose Range Profile

3.7.2.1.1 Reading Profile Template procedures

This section defines the common behavior and error conditions of the following IDD Command CP procedures to read profile templates:

- Read Basal Rate Profile Template Procedure (see Section 3.7.2.6)

- Read ISF Profile Template Procedure (see Section 3.7.2.25)

- Read I2CHO Ratio Profile Template Procedure (see Section 3.7.2.27)

- Read Target Glucose Range Template Procedure (see Section 3.7.2.29)

See Section B.1 for an example of reading a basal rate profile template.

If the Operand that was sent with a read template profile procedure Op Code (e.g., Read Basal Rate Profile) specifies a Template Number that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Read Basal Rate Profile Template), and a *Response Code Value* in the Operand set to *Parameter out of Range*.

If the Operand that was sent with a procedure Op Code (e.g., Read Basal Rate Profile) specifies a Template Number that is not configured (see Section 3.7.2.17), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Read Basal Rate Profile Template), and a *Response Code Value* in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Read Basal Rate Profile Template), and the appropriate *Response Code Value* in the Operand for the error condition as described in Sections 3.7.2.33 and 3.11.4.

3.7.2.1.2   Writing Profile Template procedures

This section defines the common behavior and error conditions of the following IDD Command CP procedures to write profile templates:

- Write Basal Rate Profile Template Procedure (see Section 3.7.2.7)

- Write ISF Profile Template Procedure (see Section 3.7.2.26)

- Write I2CHO Ratio Profile Template Procedure (see Section 3.7.2.28)

- Write Target Glucose Range Profile Template Procedure (see Section 3.7.2.30)

See Section B.2 for an example of writing a basal rate profile template.

If a Profile Template writing procedure is executed successfully (e.g., Write Basal Rate Profile Template Procedure), the Server shall set that template status to *Configured* (also see Sections 3.7.2.17 and 3.7.2.18).

Transaction Handling for Writing Profile Templates:

Due to the default MTU size, a Profile Template record could comprise up to three time blocks of the profile. Depending on the overall number of time blocks, the Server shall be able to handle one or more executions of this procedure with different values of the First Time Block Number Index field, which describes the index of the first sent time block of this Profile Template record within the entire profile template.

The Server receives all time blocks of the entire Profile Template within a transaction (see Section 3.11.2) and shall handle the transaction in the following way:

- The Server shall perform a plausibility check after each received Profile Template Record within a transaction (see below).

- The Server shall perform a plausibility check at the end of a transaction (see below).

- The Server shall discard all data of a transaction in case of any error (see below) and in case of an interruption of another CP procedure (see Section 3.11.2) and then end the transaction.

The following paragraphs describe the plausibility checks and the error handling within a transaction:

Plausibility Check After Each Received Profile Template Record:

The Server shall complete the following plausibility checks after each received Profile Template record:

- The Profile Template Number is consistent within the transaction.

- Each time block is only sent once within the transaction.

If this plausibility check is successful, the Server shall indicate the IDD Command Control Point with the corresponding response Op Code (e.g., Write Basal Rate Profile Template Response), a Flags field with bit 0 (Transaction Completed) set to *False*, a Profile Template Number field, and a First Time Block Number Index field that denotes the received First Time Block Number Index value. Otherwise, see *Error Handling for a Transaction*.

Plausibility Checks at the End of a Transaction:

When the Client indicates the end of the transaction, the Server shall perform the following plausibility checks:

- The sum of all time block durations is 24 hours (i.e., all time blocks have been received and the profile is complete).

- There are no gaps between the time blocks (e.g., a wrong First Time Block Number Index was provided by the Client).

If these checks are successful, the Server shall indicate the IDD Command Control Point with the corresponding response Op Code (e.g., Write Basal Rate Profile Template Response), a Flags field with bit 0 (Transaction Completed) set to 1, a Profile Template Number field, and a First Time Block Number Index field. Otherwise, see *Error Handling for a Transaction*.

Error Handling for a Transaction:

If one of the plausibility checks fails (see *Plausibility Check after each received Profile Template Record* and *Plausibility Checks at the End of a Transaction*), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Write Basal Rate Profile Template), and a *Response Code* Value in the Operand set to *Plausibility check failed*.

If the Server could not write a time block within a transaction, it shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Write Basal Rate Profile Template), and a *Response Code* Value in the Operand set to *Procedure not completed*.

If the Operand that was sent with a write profile template procedure Op Code (e.g., Write Basal Rate Profile Template) specifies a Template Number that is out of range, or if the First Time Block Number Index or the given time blocks exceeds the maximum number of supported time blocks per profile (see Section 3.7.2.17), or if the First Time Block Number Index is less than 1, then the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Write Basal Rate Profile Template), and a *Response Code* Value in the Operand set to *Parameter out of Range*.

If the Operand that was sent with a write profile template procedure Op Code (e.g., Write Basal Rate Profile Template) specifies a Template Number that is not configurable (see Section 3.7.2.17), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Write Basal Rate Profile Template), and a *Response Code* Value in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of the sent Op Code (e.g., Write Basal Rate Profile Template), and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.2   Set Therapy Control State procedure

If the *Set Therapy Control State* Op Code is written to the IDD Command Control Point with an Operand containing a Therapy Control State, the Server shall set the therapy control state of the Insulin Delivery Device as provided by the Operand. The Server shall confirm the new therapy control state by indicating

the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Therapy Control State, and a *Response Code* Value *of Success.*

If the therapy control state could not be set in the current application context (e.g., the Therapy Control State is set to Run although there is no inserted insulin reservoir), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Therapy Control State, and a *Response Code* Value in the Operand set to *Procedure not applicable.*

If the Therapy Control State is set to Undetermined or an RFU, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Therapy Control State, and a *Response Code* Value in the Operand set to *Invalid Operand*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set Therapy Control State, and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.3   Set Flight Mode procedure

If the *Set Flight Mode* Op Code is written to the IDD Command Control Point, the Server activates the flight mode of the Insulin Delivery Device by placing the Insulin Delivery Device into a mode accepted by the avionic authorities to allow inflight usage of the Insulin Delivery Device. The Server shall confirm the receipt of this command by indicating the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Flight Mode, and a *Response Code* Value *of Success.*

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set Flight Mode, and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.4   Snooze Annunciation procedure

If the *Snooze Annunciation* Op Code is written to the IDD Command Control Point with an Operand containing an Annunciation Instance ID, the Server shall:

- Set the Annunciation Status field of the IDD Annunciation Status characteristic (see Section 3.4) to value of *Snoozed* if this annunciation is made available.

- Set the *Annunciation Status Changed* bit of the Flags field of the IDD Status Changed characteristic (see Section 3.1) to *True.*

- Finally, snooze the corresponding annunciation, which shall still be active until it is confirmed, and indicate the IDD Command Control Point with a *Snooze Annunciation Response* Op Code and the Annunciation Instance ID of the snoozed annunciation.

The snoozing time is a limited amount of time and its value is implementation specific. As soon as the snoozing time is over, the Server shall:

- Set the Annunciation Status field of the IDD Annunciation Status characteristic (see Section 3.4) to value of *Pending* if this annunciation is made available.

- Set the *Annunciation Status Changed* bit of the Flags field of the IDD Status Changed characteristic (see Section 3.1) to *True.*

If the Operand that was sent with a *Snooze Annunciation* Op Code specifies an Annunciation Instance ID that does not exist (i.e., the Server Application has never assigned that Annunciation ID to an occurred annunciation) or is already confirmed, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Snooze Annunciation, and a *Response Code* Value in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Snooze Annunciation, and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.5 Confirm Annunciation procedure

If the *Confirm Annunciation* Op Code is written to the IDD Command Control Point with an Operand containing an Annunciation Instance ID, the Server shall:

- No longer provide information about this annunciation in the IDD Annunciation Status characteristic (see Section 3.4) when it is read by the Client.

- Set the *Annunciation Status Changed* bit of the Flags field of the IDD Status Changed characteristic (see Section 3.4) to *True.*

- Finally, indicate the IDD Command Control Point with a *Confirm Annunciation Response* Op Code and the Annunciation Instance ID of the confirmed annunciation.

If the Operand that was sent with a *Confirm Annunciation* Op Code specifies an Annunciation Instance ID that does not exist (i.e., the Server Application has never assigned that Annunciation ID to an occurred annunciation) or is already confirmed, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Confirm Annunciation, and a *Response Code* Value in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Confirm Annunciation, and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.6 Read Basal Rate Profile Template procedure

If the *Read Basal Rate Profile Template* Op Code is written to the IDD Command Control Point with an Operand containing a Basal Rate Profile Template Number, the Server shall notify the IDD Command Data characteristic (see Section 3.8) until all time blocks of the basal rate profile have been sent. The Server shall indicate the IDD Command Control Point after notifying the last response. Each notification of the IDD Command Data characteristic shall contain a *Read Basal Rate Profile Template Response* Op Code and a Basal Rate Profile Template record (see Section 3.8.1.4). Due to the default MTU size, a Basal Rate Profile Template record could comprise up to three time blocks of the basal rate profile. Depending on the overall number of time blocks, the Server shall send one or more responses. The Server shall confirm the completion of the procedure by indicating the IDD Command Control Point with a *Response Code* Op Code, a Request Op Code of *Read Basal Rate Profile Template*, and a *Response Code* Value *of Success.*

For the Read Basal Rate Profile Template Procedure, the common behavior of reading profile templates and their error conditions apply (see Section 3.7.2.1.1).

3.7.2.7 Write Basal Rate Profile Template procedure

If the *Write Basal Rate Profile Template* Op Code is written to the IDD Command Control Point with an Operand containing a Basal Rate Profile Template record, the Server shall write the time blocks within that record to the basal rate profile specified by the Basal Rate Profile Template.

For the Write Basal Rate Profile Template procedure, the common behavior of writing profile templates and their error conditions apply (see Section 3.7.2.1.2).

3.7.2.8 Set TBR Adjustment procedure

If the *Set TBR Adjustment* Op Code is written to the IDD Command Control Point with an Operand containing a TBR record, the Server shall activate a temporary basal rate based on the provided TBR settings and indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Adjustment, and a *Response Code* Value *of Success.*

If the Server supports TBR templates and the TBR record contains a TBR Template Number field, the Server shall use the settings of that TBR template and ignore the values of the Set TBR Adjustment Operand fields that are also available in that TBR template.

If the Operand that was sent with a *Set TBR Adjustment* Op Code specifies a TBR Adjustment Value, a TBR Duration, or a TBR Template Number that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Adjustment, and a *Response Code* Value in the Operand set to *Parameter out of Range.*

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Adjustment, and a *Response Code* Value in the Operand set to *Procedure not applicable* in the following cases:

- A new TBR should be set although there is a currently active TBR.

- An active TBR should be changed although there is currently no active TBR.

- The TBR Template Number denotes a template that is not configured (see Section 3.7.2.17).

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Adjustment, and a *Response Code* Value in the Operand set to *Invalid Operand* in the following cases:

- If the TBR Type is set to Undetermined, set to an RFU value, or is not supported by the Server.

- The *TBR Template Number Present* bit of the Flags field is set to 1 although the Server does not support TBR templates.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set TBR Adjustment, and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.9 Cancel TBR Adjustment procedure

If the *Cancel TBR Adjustment* Op Code is written to the IDD Command Control Point, the Server shall cancel the currently active TBR and indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Cancel TBR Adjustment, and a *Response Code* Value *of Success.*

If there is currently no active TBR, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Cancel TBR Adjustment, and a *Response Code* Value in the Operand set to *Procedure not applicable.*

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Cancel TBR Adjustment, and the appropriate *Response Code* Value in the Operand for the error condition as described in Section 3.11.4.

3.7.2.10   Get TBR Template procedure

If the *Get TBR Template* Op Code is written to the IDD Command Control Point with an Operand containing a TBR Template Number, the Server shall indicate the IDD Command Control Point with a *Get TBR Template Response* Op Code and a TBR template record.

If the Operand that was sent with a *Get TBR Template* Op Code specifies a TBR Template Number that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Get TBR Template, and a *Response Code* Value in the Operand set to *Parameter out of Range.*

If the Operand that was sent with a *Get TBR Template* Op Code specifies a TBR Template Number of a template that is not configured (see Section 3.7.2.17), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Get TBR Template, and a *Response Code Value* in the Operand set to *Procedure not applicable.*

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get TBR Template, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.11   Set TBR Template procedure

If the *Set TBR Template* Op Code is written to the IDD Command Control Point with an Operand containing a TBR template record, the Server shall write the settings of the TBR template record to the template with the corresponding TBR Template Number, set that template status to *Configured* (also see Sections 3.7.2.17 and 3.7.2.18), and then indicate the IDD Command Control Point with a *Set TBR Template Response* Op Code and TBR Template Number of the set TBR template.

If the Operand that was sent with a *Set TBR Template* Op Code specifies a TBR Template Number, a TBR Adjustment Value, or a TBR Duration that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Template, and a *Response Code Value* in the Operand set to *Parameter out of Range.*

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Template, and a *Response Code Value* in the Operand set to *Procedure not applicable* if the TBR Template Number denotes a template that is not configurable (see Section 3.7.2.17).

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set TBR Template, and a *Response Code Value* in the Operand set to *Invalid Operand* in the following cases:

- The TBR Type is set to Undetermined, set to an RFU value, or is not supported by the Server.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set TBR Template, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.12 Set Bolus procedure

If the *Set Bolus* Op Code is written to the IDD Command Control Point with an Operand containing a bolus record, the Server shall set a bolus with the provided settings and indicate the IDD Command Control Point with a *Set Bolus Response* Op Code and the Bolus ID of the set bolus. The Bolus ID shall be created by the Server Application as a unique identifier for the programmed bolus.

If the Server supports bolus templates and the bolus record contains a Bolus Template Number field, the Server shall use the settings of that bolus template and ignore the values of the Set Bolus Operand fields that are also available in that bolus template.

If the bolus of the specified type is currently not available, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus, and a *Response Code Value* in the Operand set to *Maximum Bolus Number reached.*

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus, and a *Response Code Value* in the Operand set to *Procedure not applicable* in the following cases:

- The Bolus Template Number denotes a template that is not configured (see Section 3.7.2.17).

If the Operand that was sent with a *Set Bolus* Op Code specifies a Bolus Fast Amount, a Bolus Extended Amount, a Bolus Duration, a Bolus Delay Time, or a Bolus Template Number that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus, and a *Response Code Value* in the Operand set to *Parameter out of Range*.

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus, and a *Response Code Value* in the Operand set to *Invalid Operand* in the following cases:

- The Bolus Type is set to Undetermined, set to an RFU value, or is not supported by the Server.

- Bolus Fast Amount is not 0 if Bolus Type is "Extended".

- Bolus Extended Amount is not 0 if Bolus Type is "Fast".

- Bolus Duration is not 0 if Bolus Type is "Fast".

- The *Bolus Delay Time Present* bit of the Flags field is set to 1 although the Server does not support a bolus delay time.

- The *Bolus Template Number Present* bit of the Flags field is set to 1 although the Server does not support bolus templates.

- The *Bolus Activation Type Present* bit of the Flags field is set to 1 although the Server does not support a bolus activation type.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set Bolus, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.13 Cancel Bolus procedure

If the *Cancel Bolus* Op Code is written to the IDD Command Control Point with a Bolus ID field, the Server shall cancel the bolus identified by the specified Bolus ID and indicate the IDD Command Control Point with a *Cancel Bolus Response* Op Code and the Bolus ID of the canceled bolus.

If the Operand that was sent with a *Cancel Bolus* Op Code specifies an invalid Bolus ID (e.g., a Bolus ID that does not exist (i.e., the Server Application has never assigned that Bolus ID to a set bolus) or identifies a bolus that is not currently active), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Cancel Bolus, and a *Response Code Value* in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Cancel Bolus, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.14 Get Available Boluses procedure

If the *Get Available Boluses* Op Code is written to the IDD Command Control Point, the Server shall check which bolus types are currently available to be set and indicate the IDD Command Control Point with a *Get Available Boluses Response* Op Code and a Flags field.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Available Boluses, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.15 Get Bolus Template procedure

If the *Get Bolus Template* Op Code is written to the IDD Command Control Point with an Operand containing a Bolus Template Number, the Server shall indicate the IDD Command Control Point with a *Get Bolus Template Response* Op Code and a bolus template record.

If the Operand that was sent with a *Get Bolus Template* Op Code specifies a Bolus Template Number that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Get Bolus Template, and a *Response Code Value* in the Operand set to *Parameter out of Range*.

If the Operand that was sent with a *Get Bolus Template* Op Code specifies a Bolus Template Number of a template that is not configured (see Section 3.7.2.17), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Get Bolus Template, and a *Response Code Value* in the Operand set to *Procedure not applicable*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Bolus Template, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.16 Set Bolus Template procedure

If the *Set Bolus Template* Op Code is written to the IDD Command Control Point with an Operand containing a Bolus Template record, the Server shall write the settings of the bolus template record to the template with the corresponding Bolus Template Number, set that template status to *Configured* (also see Sections 3.7.2.17 and 3.7.2.18), and then indicate the IDD Command Control Point with a *Set Bolus Template Response* Op Code and the Bolus Template Number of the set bolus template.

If a Bolus Template writing procedure is executed successfully (e.g., Write Basal Rate Profile Template Procedure), the Server shall set that template status to *Configured* (also see Sections 3.7.2.17 and 3.7.2.18).

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus Template, and a *Response Code Value* in the Operand set to *Procedure not applicable* in the following cases:

• The Bolus Template Number denotes a template that is not configurable (see Section 3.7.2.17).

If the Operand that was sent with a *Set Bolus* Op Code specifies a Bolus Fast Amount, a Bolus Extended Amount, a Bolus Duration, a Bolus Delay Time, or a Bolus Template Number that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus Template, and a *Response Code Value* in the Operand set to *Parameter out of Range*.

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Bolus Template, and a *Response Code Value* in the Operand set to *Invalid Operand* in the following cases:

• The Bolus Type is set to Undetermined, set to an RFU value, or is not supported by the Server.

• Bolus Fast Amount is not 0 if Bolus Type is "Extended".

• Bolus Extended Amount is not 0 if Bolus Type is "Fast".

• Bolus Duration is not 0 if Bolus Type is "Fast".

• The *Bolus Delay Time Present* bit of the Flags field is set to 1 although the Server does not support a bolus delay time.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set Bolus Template, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.17 Get Template Status and Details procedure

If the *Get Template Status and Details* Op Code is written to the IDD Command Control Point, the Server shall notify the IDD Command Data characteristic (see Section 3.8) until all supported template status and details records have been sent. The Server shall indicate the IDD Command Control Point after notifying the last template status and details record. Each notification of the IDD Command Data shall contain a *Get Template Status and Details Response* Op Code and a supported template status and details record (see Section 3.8.1.8). The Server shall confirm the completion of the procedure by indicating the IDD Command Control Point with a *Response Code* Op Code, a Request Op Code of *Get Template Status and Details*, and *Response Code Value* of *Success*.

See Section Appendix C for an example of getting the template status and details.

Only configured templates can be read, applied, or reset (see Section 3.7.2.18) by the Client, and only configurable templates can be written by the Client. The Server may predefine a template and then mark it as *Configured* (by setting the corresponding bit of the Flags field to *True*) if it shall be:

- readable (e.g., the Read Basal Rate Profile Template Procedure can be executed with that template, also see common behavior of reading profile templates in Section 3.7.2.1.1),

- applicable (e.g., the Set Bolus Procedure or Activate Profile Templates Procedure can be executed with that template, see Sections 3.7.2.12 and 3.7.2.19 respectively), and

- resettable (i.e., the Reset Template Status Procedure can be executed, see Section 3.7.2.18)

by the Client.

The Server may also predefine a template (i.e., in that case the Server shall mark that template as *Configured* and mark it as *Not Configurable* by setting the corresponding bit of the Flags field to *False*) to prevent a Client from changing its parameters.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Template Status and Details, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.18 Reset Template Status procedure

If the *Reset Template Status* Op Code is written to the IDD Command Control Point with an Operand containing a Number of Templates to Reset field and a Template Numbers field, the Server shall mark the templates identified by the Template Numbers field as *Not Configured* and indicate the IDD Command Control Point with a *Reset Template Status Response* Op Code, a Number of Templates Reset field, and a Template Numbers field of the reset template(s).

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Reset Template Status, and a *Response Code Value* in the Operand set to *Procedure not applicable* in the following cases:

- A template specified by the Template Numbers field is not valid (e.g., the Template Number does not identify a template available on the Server. See Section 3.7.2.17 for more details.)

- A template specified by the Template Numbers field is not configured (see Section 3.7.2.17) because it was never configured or already reset.

- A template specified by the Template Numbers field is not configurable (see Section 3.7.2.17) and therefore cannot be reset.

- A template specified by the Template Numbers field is a currently activated profile template.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Reset Template Status, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

In case of any error condition of the operation (e.g., if at least one profile template in the Operand could not be reset for any reason or is invalid), the Server shall discard all data of the procedure and shall not reset any profile template.

3.7.2.19   Activate Profile Templates procedure

If the *Activate Profile Templates* Op Code is written to the IDD Command Control Point with an Operand containing a Number of Profile Templates to Activate field and a Profile Template Numbers field, the Server shall activate the profile templates identified by the Profile Template Numbers field and indicate the IDD Command Control Point with an *Active Profile Templates Response* Op Code, a Number of Profile Templates Activated field, and a Profile Template Numbers field*.*

The Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Activate Profile Templates, and a *Response Code Value* in the Operand set to *Procedure not applicable* in the following cases:

- A profile template specified by the Profile Template Numbers field is not valid (e.g., the profile template number does not identify a profile template available on the Server. See Section 3.7.2.17 for more details.)

- A profile template specified by the Profile Template Numbers field is not configured (see Section 3.7.2.17).

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Activate Profile Templates, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

In case of any error condition of the operation (e.g., if at least one profile template in the Operand could not be activated for any reason or is invalid), the Server shall discard all data of the procedure and shall not activate any profile template.

3.7.2.20   Get Activated Profile Templates procedure

If the *Get Activated Profile Templates* Op Code is written to the IDD Command Control Point, the Server shall indicate the IDD Command Control Point with a *Get Activated Profile Templates Response* Op Code, a Number of Activated Profile Templates field, and a Profile Template Numbers field of the currently activated profile templates.

If there are currently no activated profile templates, the Server shall set the Number of Activated Profile Templates field to 0 and not include the Profile Template Numbers field in the response.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Activated Profile Template, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.21   Start Priming procedure

If the *Start Priming* Op Code is written to the IDD Command Control Point with an Operand containing an Amount field, the Server shall start the priming of the fluidic path of the Insulin Delivery Device by starting the delivery of the provided amount of insulin and indicate the IDD Command Control Point with a

Response Code Op Code, a *Request Op Code* of Start Priming, and a *Response Code Value of Success.*

The Server shall stop the priming as soon as the provided insulin amount is delivered.

If the Operand that was sent with a *Start Priming* Op Code specifies an amount that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Start Priming, and a *Response Code Value* in the Operand set to *Parameter out of Range*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Start Priming, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.22 Stop Priming procedure

If the *Stop Priming* Op Code is written to the IDD Command Control Point, the Server shall stop the priming immediately and indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Stop Priming, and a *Response Code Value of Success.*

If the priming was not started before by executing the *Start Priming* procedure (see Section 3.7.2.19), or the priming was already finished (i.e., the provided amount of insulin to fill the fluidic path was delivered completely), the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Stop Priming, and a *Response Code Value* in the Operand set to *Procedure not applicable.*

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Stop Priming, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.23 Set Initial Reservoir Fill Level procedure

If the *Set Initial Reservoir Fill Level* Op Code is written to the IDD Command Control Point with an Operand containing a Fill Level field, the Server shall set the fill level of the reservoir to the provided insulin level and indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Initial Reservoir Fill Level, and a *Response Code Value of Success.*

If the Operand that was sent with a *Set Initial Reservoir Fill Level* Op Code specifies a fill level that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Initial Reservoir Fill Level, and a *Response Code Value* in the Operand set to *Parameter out of Range*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set Initial Reservoir Fill Level, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.24 Reset Reservoir Insulin Operation Time

If the *Reset Reservoir Insulin Operation Time* Op Code is written to the IDD Command Control Point, the Server shall reset the *Reservoir Insulin Operation Time* counter (retrieved by procedure *Get Counter* of IDD Status Reader CP with Counter Type *Reservoir Insulin Operation Time)* and indicate the IDD

Command Control Point with a *Response Code* Op Code, a *Request Op Code* of
Reset Reservoir Insulin Operation Time, and a *Response Code Value of Success*. The reset of the
Reservoir Insulin Operation Time counter shall be done by setting the *Remaining* counter value to the
default of the Server Application and the *Elapsed* counter value to 0.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a
Request Op Code of Reset Reservoir Insulin Operation Time, and the appropriate *Response Code Value*
in the Operand for the error condition as described in Section 3.11.4.

3.7.2.25   Read ISF Profile Template procedure

If the *Read ISF Profile Template* Op Code is written to the IDD Command Control Point with an Operand
containing an ISF Profile Template Number, the Server shall notify the IDD Command Data characteristic
(see Section 3.8) until all time blocks of the ISF profile have been sent. The Server shall indicate the IDD
Command Control Point after notifying the last response. Each notification of the IDD Command Data
characteristic shall contain a *Read ISF Profile Template Response* Op Code and an ISF Profile Template
record (see Section 3.8.1.5). Due to the default MTU size, an ISF Profile Template record could comprise
up to three time blocks of the ISF profile. Depending on the overall number of time blocks, the Server
shall send one or more responses. The Server shall confirm the completion of the procedure by indicating
the IDD Command Control Point with a *Response Code* Op Code, a Request Op Code of *Read ISF
Profile Template*, and a *Response Code Value of Success.*

For the Read ISF Profile Template Procedure, the common behavior of reading profile templates and
their error conditions apply (see Section 3.7.2.1.1).

The reading sequence (i.e., writing to IDD Command CP, receiving of notifications, and final indication) of
ISF profiles is the same as with basal rate profiles.

3.7.2.26   Write ISF Profile Template procedure

If the *Write ISF Profile Template* Op Code is written to the IDD Command Control Point with an Operand
containing an ISF Profile Template record, the Server shall write the time blocks within that record to the
ISF profile specified by the ISF Profile Template.

For the Write ISF Profile Template procedure, the common behavior of writing profile templates and their
error conditions apply (see Section 3.7.2.1.2).

The writing sequence (i.e., writing to IDD Command CP, receiving of notifications, and final indication) of
ISF profiles is the same as with basal rate profiles.

3.7.2.27   Read I2CHO Ratio Profile Template procedure

If the *Read I2CHO Ratio Profile Template* Op Code is written to the IDD Command Control Point with an
Operand containing an I2CHO Ratio Profile Template Number, the Server shall notify the IDD Command
Data characteristic (see Section 3.8) until all time blocks of the I:CHO ratio profile have been sent. The
Server shall indicate the IDD Command Control Point after notifying the last response. Each notification
of the IDD Command Data characteristic shall contain a *Read I2CHO Ratio Profile Template Response*
Op Code and an I2CHO Ratio Profile Template record (see Section 3.8.1.6). Due to the default MTU size,
an I:CHO Ratio Profile Template record could comprise up to three time blocks of the I:CHO ratio profile.
Depending on the overall number of time blocks, the Server shall send one or more responses. The

Server shall confirm the completion of the procedure by indicating the IDD Command Control Point with a *Response Code* Op Code, a Request Op Code of *Read I2CHO Ratio Profile Template*, and a *Response Code Value of Success.*

For the Read I2CHO Ratio Profile Template Procedure, the common behavior of reading profile templates and their error conditions apply (see Section 3.7.2.1.1).

The reading sequence (i.e., writing to IDD Command CP, receiving of notifications, and final indication) of I:CHO ratio profiles is the same as with basal rate profiles.

3.7.2.28 Write I2CHO Ratio Profile Template procedure

If the *Write I2CHO Ratio Profile Template* Op Code is written to the IDD Command Control Point with an Operand containing an I2CHO Ratio Profile Template record, the Server shall write the time blocks within that record to the I:CHO ratio profile specified by the I:CHO Profile Template.

For the Write I2CHO Ratio Profile Template Procedure, the common behavior of writing profile templates and their error conditions apply (see Section 3.7.2.1.2).

The writing sequence (i.e., writing to IDD Command CP, receiving of notifications, and final indication) of I:CHO ratio profiles is the same as with basal rate profiles.

3.7.2.29 Read Target Glucose Range Profile Template procedure

If the *Read Target Glucose Range Profile Template* Op Code is written to the IDD Command Control Point with an Operand containing a Target Glucose Range Profile Template Number, the Server shall notify the IDD Command Data characteristic (see Section 3.8) until all time blocks of the target glucose range profile have been sent. The Server shall indicate the IDD Command Control Point after notifying the last response. Each notification of the IDD Command Data characteristic shall contain a *Read Target Glucose Range Profile Template Response* Op Code and a Target Glucose Range Profile Template record (see Section 3.8.1.7). Due to the default MTU size, a Target Glucose Range Profile Template record could comprise up to three time blocks of the target glucose range profile. Depending on the overall number of time blocks, the Server shall send one or more responses. The Server shall confirm the completion of the procedure by indicating the IDD Command Control Point with a *Response Code* Op Code, a Request Op Code of *Read Target Glucose Range Profile Template*, and a *Response Code Value of Success.*

For the Read Target Glucose Range Profile Template Procedure, the common behavior of reading profile templates and their error conditions apply (see Section 3.7.2.1.1).

The reading sequence (i.e., writing to IDD Command CP, receiving of notifications, and final indication) of target glucose range profiles is the same as with basal rate profiles.

3.7.2.30 Write Target Glucose Range Profile Template procedure

If the *Write Target Glucose Range Profile Template* Op Code is written to the IDD Command Control Point with an Operand containing a Target Glucose Range Profile Template record, the Server shall write the time blocks within that record to the target glucose range profile specified by the Target Glucose Range Profile Template.

For the Write Target Glucose Range Profile Template Procedure, the common behavior of writing profile templates and their error conditions apply (see Section 3.7.2.1.2).

The writing sequence (i.e., writing to IDD Command CP, receiving of notifications, and final indication) of target glucose range profiles is the same as with basal rate profiles.

3.7.2.31   Get Max Bolus Amount procedure

If the *Get Max Bolus Amount* Op Code is written to the IDD Command Control Point, the Server shall indicate the IDD Command Control Point with a *Get Max Bolus Amount Response* Op Code and a Max Bolus Amount field.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Get Max Bolus Amount, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.32   Set Max Bolus Amount procedure

If the *Set Max Bolus Amount* Op Code is written to the IDD Command Control Point with an Operand containing a Max Bolus Amount field, the Server shall set the maximum bolus amount to that value and indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Max Bolus Amount, and a *Response Code Value of Success.*

If the Operand that was sent with a *Set Max Bolus Amount* Op Code specifies a maximum bolus amount that is out of range, the Server shall indicate the IDD Command Control Point with a *Response Code* Op Code, a *Request Op Code* of Set Max Bolus Amount, and a *Response Code Value* in the Operand set to *Parameter out of Range*.

If the operation results in an error condition, this shall be indicated using a *Response Code* Op Code, a *Request Op Code* of Set Max Bolus Amount, and the appropriate *Response Code Value* in the Operand for the error condition as described in Section 3.11.4.

3.7.2.33   IDD Command CP specific errors

If the Op Code that was written to the Control Point characteristic requires notifications of the IDD Command Data characteristic and its Client Characteristic Configuration descriptor is not configured for notifications, the Server shall return an error response with the Attribute Protocol Application error code set to *Client Characteristic Configuration Descriptor Improperly Configured*.

3.8   IDD Command Data

The IDD Command Data characteristic is composed of response records from executed procedures of the IDD Command Control Point.

3.8.1   Characteristic behavior

When the *Client Characteristic Descriptor* of the IDD Command Data characteristic is configured for notifications, the IDD Command Control Point shall be used to control notifications of this characteristic.

3.8.1.1   Response Op Code field

The Response Op Code field shall be included in the IDD Command Data characteristics.

The Response Op Code field contains the *Response Op Code* of the executed procedure of the IDD Command Control Point.

3.8.1.2 Operand field

The Operand field shall be included in the IDD Command Data characteristics.

The Operand field is composed of the response data depending on the specific *Op Code* of the Response Op Code field (see Section 3.8.1.3).

3.8.1.3 Response Op Code specific Operands in context of Insulin Delivery Service

The following chapters describe the structure of the Operand field depending on the *Response Op Code* of the executed procedure on the IDD Command Control Point.

3.8.1.4 Operand of Read Basal Rate Profile Template Response

The Operand of the Read Basal Rate Profile Template Response Op Code could contain up to three time blocks, which are described by their durations in minutes and their rates in International Unit per hour (IU/h). Depending on the overall number of time blocks and due to the default MTU size, several records may be notified to the IDD Command Data characteristic to read a complete basal rate profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire basal rate profile (i.e., the index of the second time block shall be calculated by adding a value of 1 to that field and a value of 2 shall be added to get the index of the third time block).

The Operand is composed of a Flags field that signals the presence of the fields of the second and third time blocks within this record, a Basal Rate Profile Template Number field that is the basal rate profile template number of the read basal rate profile, and a First Time Block Number Index field that represents the index of the following time blocks fields within the entire basal rate profile. The Operand is closed by the fields with the durations and amounts of the (up to) three time blocks.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Basal Rate Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First Rate	M	SFLOAT	2	IU/h	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second Rate	C.1	SFLOAT	2	IU/h	LSO…MSO
Third Duration	C.2	uint16	2	minutes	LSO…MSO

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Third Rate	C.2	SFLOAT	2	IU/h	LSO…MSO
MSO ↑					

Table 3.11: IDD Command Data Read Basal Rate Profile Template Response Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.

3.8.1.4.1   Flags field

Bit	Definition	Description
0	Second Time Block Present	If this bit is set, the fields Second Duration and Second Rate are present.
1	Third Time Block Present	If this bit is set, the fields Third Duration and Third Rate are present.
2 – 7	RFU	None

Table 3.12: Read Basal Rate Profile Template Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

3.8.1.5   Operand of Read ISF Profile Template Response

The Operand of the Read ISF Profile Template Response Op Code could contain up to three time blocks, which are described by their durations in minutes and their insulin sensitivity factors in milligram per deciliter (mg/dL). Depending on the overall number of time blocks and due to the default MTU size, several records may be notified to the IDD Command Data characteristic to read a complete ISF profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire ISF profile (i.e., the index of the second time block shall be calculated by adding a value of 1 to that field and a value of 2 shall be added to get the index of the third time block).

The Operand is composed of a Flags field that signals the presence of the fields of the second and third time blocks within this record, an ISF Profile Template Number field that is the ISF profile template number of the read ISF profile, and a First Time Block Number Index field that represents the index of the following time blocks fields within the entire ISF profile. The Operand is closed by the fields with the durations and insulin sensitivity factors of the (up to) three time blocks.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
ISF Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First ISF	M	SFLOAT	2	mg/dL	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second ISF	C.1	SFLOAT	2	mg/dL	LSO…MSO
Third Duration	C.2	uint16	2	minutes	LSO…MSO
Third ISF	C.2	SFLOAT	2	mg/dL	LSO…MSO
MSO ↑					

Table 3.13: IDD Command Data Read ISF Profile Template Response Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.

3.8.1.5.1   Flags field

Bit	Definition	Description
0	Second Time Block Present	If this bit is set, the fields Second Duration and Second ISF are present.
1	Third Time Block Present	If this bit is set, the fields Third Duration and Third ISF are present.
2 – 7	RFU	None

Table 3.14: Read ISF Profile Template Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

3.8.1.6   Operand of Read I2CHO Ratio Profile Template Response

The Operand of the Read I2CHO Ratio Profile Template Response Op Code could contain up to three time blocks that are described by their durations in minutes and their insulin-to-carbohydrate ratios in gram. Depending on the overall number of time blocks and due to the default MTU size, several records may be notified to the IDD Command Data characteristic to read a complete I:CHO ratio profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire I:CHO ratio profile (i.e., the index of the second time block shall be calculated by adding a value of 1 to that field and a value of 2 shall be added to get the index of the third time block).

The Operand is composed of a Flags field that signals the presence of the fields of the second and third time blocks within this record, an I2CHO Ratio Profile Template Number field that is the I:CHO ratio profile template number of the read I:CHO ratio profile, and a First Time Block Number Index field that represents the index of the following time blocks fields within the entire I:CHO ratio profile. The Operand is closed by the fields with the durations and insulin-to-carbohydrate ratios of the (up to) three time blocks.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
I2CHO Ratio Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First I2CHO Ratio	M	SFLOAT	2	grams	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second I2CHO Ratio	C.1	SFLOAT	2	grams	LSO…MSO
Third Duration	C.2	uint16	2	minutes	LSO…MSO
Third I2CHO Ratio	C.2	SFLOAT	2	grams	LSO…MSO
MSO ↑					

Table 3.15: IDD Command Data Read I2CHO Ratio Profile Template Response Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.

3.8.1.6.1   Flags field

Bit	Definition	Description
0	Second Time Block Present	If this bit is set, the fields Second Duration and Second I2CHO Ratio are present.
1	Third Time Block Present	If this bit is set, the fields Third Duration and Third I2CHO Ratio are present.
2 – 7	RFU	None

Table 3.16: Read I2CHO Ratio Profile Template Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

3.8.1.7   Operand of Read Target Glucose Range Profile Template Response

The Operand of the Read Target Glucose Range Profile Template Response Op Code could contain up to two time blocks that are described by their durations in minutes and their lower and upper target glucose limits in mg/dL. Depending on the overall number of time blocks and due to the default MTU size, several records may be notified to the IDD Command Data characteristic to read a complete target glucose range profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire target glucose range profile (i.e., the index of the second time block shall be calculated by adding a value of 1 to that field).

The Operand is composed of a Flags field that signals the presence of the fields of the second time block within this record, a Target Glucose Range Profile Template Number field that is the target glucose range profile template number of the read target glucose range profile, and a First Time Block Number Index field that represents the index of the following time blocks fields within the entire target glucose range profile. The Operand is closed by the fields with the durations and lower and upper target glucose limits of the (up to) two time blocks.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Target Glucose Range Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First Lower Target Glucose Limit	M	SFLOAT	2	mg/dL	LSO…MSO
First Upper Target Glucose Limit	M	SFLOAT	2	mg/dL	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second Lower Target Glucose Limit	C.1	SFLOAT	2	mg/dL	LSO…MSO
Second Upper Target Glucose Limit	C.1	SFLOAT	2	mg/dL	LSO…MSO
MSO ↑					

Table 3.17: IDD Command Data Read Target Glucose Range Profile Template Response Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.

3.8.1.7.1   Flags field

Bit	Definition	Description
0	Second Time Block Present	If this bit is set, the fields Second Duration, Second Lower Target Glucose Limit, and Second Upper Target Glucose Limit are present.
1 – 7	RFU	None

Table 3.18: Read I2CHO Ratio Profile Template Response Operand Flags Field

Note: The bits in the table above are defined as: 0 = False and 1 = True

3.8.1.8   Operand of Get Template Status and Details Response

Depending on the supported template types, which are identified in the IDD Features characteristic, multiple template status and details records may be notified to the IDD Command Data characteristic (i.e., a response is notified for each supported template type).

Each template has a unique number such that the template type can be identified by the template number. That is, if the Server Application supports only basal rate profile templates and ISF profile templates, the template number of any of the basal rate or ISF profile templates is unique across all basal rate and ISF profile templates. For example, a basal rate profile template has a template number value of *0x01*. Using this template number value in any procedure or history event would reference that basal rate profile template.

Each template type supported by the Server Application is allotted a range of unique template numbers and it is up to the Server Application to specify these ranges. The template type has a starting template number and number of templates, which determine the starting location and length of that template type's template number range. For example, a template type with starting template number of 1 and number of templates of 3 would identify its templates by the template numbers 1, 2 and 3.

The Operand of the Get Template Status and Details Response Op Code is composed of a Template Type field, a Starting Template Number field, a Number of Templates field, a Max Number of Supported Time Blocks field, and a Configured and Configurable Flags field.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Template Type	M	Enumeration of uint8	1	None	N/A
Starting Template Number	M	uint8	1	None	N/A
Number of Templates	M	uint8	1	None	N/A

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Max Number of Supported Time Blocks	M[1]	uint8	1	None	N/A
Configurable and Configured Flags	M	Array of 2bit	1 to 11	None	LSO…MSO
MSO ↑					

Table 3.19: IDD Command CP Get Supported Template Details and Status Response Operand

[1] Shall be set to 0 if the Template Type field value is not a Profile Template type

3.8.1.8.1   Template Type values

The following values are defined for the Template Type field:

Description	Value
Undetermined	0x0F
Basal Rate Profile Template	0x33
TBR Template	0x3C
Bolus Template	0x55
ISF Profile Template	0x5A
I2CHO Ratio Profile Template	0x66
Target Glucose Range Profile Template	0x96
RFU	All not already defined Hamming code values within 0x00 and 0xFF
Prohibited	All other values

Table 3.20: Get Supported Template Details and Status Response Operand Template Type

3.8.1.8.2   Starting Template Number field

The Starting Template Number field value is the template number of the first template of the template type identified in the Template Type field.

3.8.1.8.3   Number of Templates field

The Number of Templates field value is the total number of templates for the reported template type supported by the Server Application.

3.8.1.8.4   Max Number of Supported Time Blocks field

The Max Number of Supported Time Blocks field is the maximum number of time blocks of the requested template type that is supported by the Server Application. The value of this field depends on the Template Type field in Section 3.8.1.8.1. If the template type is not a Profile Template type, the value of the Max Number of Supported Time Blocks field shall be set to 0; otherwise this field shall not be set to 0.

3.8.1.8.5 Configurable and Configured Flags field

The Configurable and Configured Flags field is an array of 2 bit values where the first bit is the configurable status of the template and the second bit is the configured status of the template. If the configurable bit, bit 0, is set to 1 (= True), then this template is configurable and can be configured by the Collector Application. If the configured bit, bit 1, is set to 1 (= True), then this template is configured and does contain data. The total number of elements in this array is the value of the Number of Templates field in Section 3.8.1.8.3. A padding of bits (set to 0) shall be appended if the number of elements of the Configurable and Configured Flags field does not fill a whole number of octets.

3.8.1.9 E2E-Counter field and E2E-CRC field (optional)

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field followed by an E2E-CRC field shall be included in the IDD Command Data characteristic.

3.9 IDD Record Access Control Point

The IDD Record Access Control Point (IDD RACP) is based on the Record Access Control Point (RACP) and is defined in [6]. The IDD RACP is used for basic management and access of the history database of the Server including historical data of the insulin therapy, device state changes, and annunciations.

In comparison to the RACP, the values of the IDD RACP Op Codes (see Section 3.9.3.1), Operators (see Section 3.9.3.2), and the Response Code of *Success* (see Section 3.9.3.3) are defined with Hamming distances to cover the aspect of functional safety, which must be implemented by Sensor and Collector Applications for Insulin Delivery Devices (see Section 5). Furthermore, the IDD RACP enables E2E-Protection (see Section 1.9) by additional E2E-Counter and E2E-CRC fields that are attached if the device supports E2E-Protection.

If the Client executes a procedure on the IDD Record Access Control Point, the Server shall send the requested information by notifications of the IDD History Data characteristic (see Section 3.10) and shall indicate the IDD Record Access Control Point to confirm the end of executed procedure.

3.9.1 Structure

The structure is as follows:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Op Code (see Table 3.25)	M	Enumeration of uint8	1	None	N/A
Operator (see Table 3.26)	M	Enumeration of uint8	1	None	N/A
Operand (see Table 3.22)	C.1	Variable	0 to 9	None	LSO…MSO

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
E2E-Counter	C.2	uint8	1	N/A	N/A
E2E-CRC	C.2	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 3.21: IDD Record Access Control Point

C.1:   Mandatory depending on Operator, otherwise excluded.

C.2:   Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

3.9.2   History record definition

Within the context of the Insulin Delivery Service, a history record consists of an IDD History Data characteristic value according to Section 3.10. The device implementing the Server shall persistently store the history record data for retrieval by Clients.

3.9.3   IDD Record Access Control Point procedure requirements

Table 3.22 shows the requirements for the IDD Record Access Control Point procedures (Op Codes and Operands) in the context of this service:

Commands						
Op Code (see Table 3.25)	**Op Code Requirement**	**Operator (see Table 3.26)**	**Operator Requirement**	**Operand**		**Operand Requirement**
				Filter Type (see Table 3.24)	**Filter Parameters (see Table 3.23)**	
Report Stored Records, Report Number of Stored Records	M	All records	M	No Operand Used		N/A
		Less than or equal to	O	Sequence Number	<maximum filter value>	C.1
				Sequence Number filtered by Reference Time Event		O
				Sequence Number filtered by Non-Reference Time Event		
		Greater than or equal to	M	Sequence Number	<minimum filter value>	M
				Sequence Number filtered by Reference Time Event		O

Commands						
Op Code (see Table 3.25)	**Op Code Requirement**	**Operator** (see Table 3.26)	**Operator Requirement**	**Operand**		**Operand Requirement**
				Filter Type (see Table 3.24)	**Filter Parameters** (see Table 3.23)	
				Sequence Number filtered by Non-Reference Time Event		
		Within range of (inclusive)	O	Sequence Number	<minimum filter value>, <maximum filter value>	C.1
				Sequence Number filtered by Reference Time Event		O
				Sequence Number filtered by Non-Reference Time Event		
		First record	O	No Operand Used		N/A
		Last record	O	No Operand Used		N/A
Delete Stored Records	O	All records	C.2	No Operand Used		N/A
		Less than or equal to	O	Sequence Number	<maximum filter value>	C.3
				Sequence Number filtered by Reference Time Event		
				Sequence Number filtered by Non-Reference Time Event		
		Greater than or equal to	O	Sequence Number	<minimum filter value>	C.3
				Sequence Number filtered by Reference Time Event		
				Sequence Number filtered by Non-Reference Time Event		
		Within range of (inclusive)	O	Sequence Number	<minimum filter value>, <maximum filter value>	C.3
				Sequence Number filtered by Reference Time Event		

Commands						
Op Code **(see Table 3.25)**	**Op Code Require ment**	**Operator** **(see Table 3.26)**	**Operator Require ment**	**Operand**		**Operand Require ment**
				Filter Type **(see Table 3.24)**	**Filter Parameters** **(see Table 3.23)**	
				Sequence Number filtered by Non-Reference Time Event		
		First record	O	No Operand Used		N/A
		Last record	O	No Operand Used		N/A
Abort Operation	M	Null (0x0F)	M	No Operand Used		N/A
Responses						
Op Code	**Op Code Require ment**	**Operator**	**Operator Require ment**	**Operand**		**Operand Require ment**
Number of Stored Records Response	M	Null (0x0F)	M	uint32 containing number of records		M
Response Code	M	Null (0x0F)	M	Request Op Code, Response Code Value		M

Table 3.22: IDD RACP Procedure Requirements

C.1   If this Operator is supported, this Operand is mandatory for this Operator, otherwise excluded.
         Also see Note 1.

C.2   If this Op Code is supported, this Operator is mandatory for this Op Code, otherwise excluded.
         Also see Note 2.

C.3   If this Operator is supported, at least one of the Operands is mandatory for this Operator,
         otherwise excluded.
         Also see Note 1.

Notes:

1. Support for a given Operand for one Op Code and Operator combination does not imply support of that Operand for other Op Code and Operator combinations.
2. Support for a given Operator for one Op Code does not imply support of that Operator for other Op Codes.

3. Where a filter type and filter parameters are used, the byte order for the Operand is specified in subsection 3.9.3.1.

Table 3.23 shows the relationships between IDD RACP Operators and Operands:

Procedure Operator	Operand Description
Null	An Operand is used only in the case of the responses *Number of Stored Records Response* and *Response Code* as shown in Table 3.22.
All records	No Operand Used
Less than or equal to	Operand represents Filter Type (see Table 3.24) and maximum field value
Greater than or equal to	Operand represents Filter Type (see Table 3.24) and minimum field value
Within range of (inclusive)	Operand represents Filter Type (see Table 3.24) and minimum field value, maximum field value pair
First record	No Operand Used
Last record	No Operand Used

Table 3.23: IDD RACP Procedure Operator and Operand Relationships

Note that when using the 'within range of' Operator, the minimum value of the range shall be a less than or equal to the maximum value of the range regardless of the Filter Type used in the Operand.

The following table shows the Filter Types that apply to the Operators listed in Table 3.23. Within the Operand, the Filter Type specifies the field of the IDD History Data characteristic value upon which the filtering is based. See Section 3.9.3.1 for further information.

Operand Filter Type Value	Filter Type Description	Meaning
0x0F	Sequence Number	The history records are filtered based on their *Sequence Number*
0x33	Sequence Number filtered by Reference Time Event	The history records are filtered based on their *Sequence Number* and on both Event Types *Reference Time Event* and *Reference Time Base Offset Event*
0x3C	Sequence Number filtered by Non-Reference Time Event	The history records are filtered based on their *Sequence Number* and on all Event Types that are not *Reference Time Event* and not *Reference Time Base Offset Event*
All not already defined Hamming code values within 0x00 and 0xFF	RFU	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.

Operand Filter Type Value	Filter Type Description	Meaning
All other values	Prohibited	All values not defined above are prohibited.

Table 3.24: IDD RACP Filter Types

3.9.3.1 Op Codes in context of Insulin Delivery Service

The Op Codes of the IDD RACP are defined in Table 3.25:

Op Code Value	Definition	Operator	Operand	Description
0x0F	Response Code	Null (value of 0x0F from Table 3.26)	Request Op Code, Response Code Value (see Table 3.27)	Response to corresponding Op Code.
0x33	Report Stored Records	An appropriate value from Table 3.26	Filter parameters (as appropriate to Operator and this service)	Gets the selected set of stored history records based on the filter criteria specified in the Operator and Operand. The response to this control point is Response Code.
0x3C	Delete Stored Records	An appropriate value from Table 3.26	Filter parameters (as appropriate to Operator and this service)	Deletes the specified history records based on Operator and Operand values. The response to this control point is Response Code.
0x55	Abort Operation	Null (value of 0x0F from Table 3.26)	Not included	Stops any IDD RACP procedures currently in progress. The response to this control point is Response Code.
0x5A	Report Number of Stored Records	An appropriate value from Table 3.26	Filter parameters (as appropriate to Operator and this service)	Calculates and responds with a history record count based on filter criteria and Operator and Operand values. The normal response to this control point is *Report Number Of Stored Records Response*. For error conditions, the response is *Response Code*.

Op Code Value	Definition	Operator	Operand	Description
0x66	Number of Stored Records Response	Null (value of 0x0F from Table 3.26)	Number of Records (Field size defined by this service)	This is the normal response to *Report Number Of Stored Records*.
All not already defined Hamming code values within 0x00 and 0xFF	RFU	N/A	N/A	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
All other values	Prohibited	N/A	N/A	All values not defined above are prohibited.

Table 3.25: IDD RACP Op Codes

3.9.3.2 Operators

The Operator values associated with the IDD RACP are defined in Table 3.26:

Operator Value	Definition	Description
0x0F	Null	Value used for Op Codes that do not have an Operator.
0x33	All records	All stored history records.
0x3C	Less than or equal to	History records less than or equal to specified Operand.
0x55	Greater than or equal to	History records greater than or equal to specified Operand.
0x5A	Within range of (inclusive)	Inclusive range of history records specified by Operand.
0x66	First record	Oldest history record.
0x69	Last record	Most recent history record.
All not already defined Hamming code values within 0x00 and 0xFF	RFU	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
All other values	Prohibited	All values not defined above are prohibited.

Table 3.26: IDD RACP Operators

3.9.3.3 Response Codes

The Response Code Values associated with the IDD Record Access Control Point are defined in Table 3.27:

Response Code Value	Definition	Description
0x02	Op Code not supported	Error response if unsupported Op Code is received (e.g., Op Code from RFU range).
0x03	Invalid Operator	Error response if Operator received does not meet the requirements of the service (e.g., Null was expected, Operator from Prohibited range).
0x04	Operator not supported	Error response if unsupported Operator is received (e.g., Operator from RFU range).
0x05	Invalid Operand	Error response if Operand received does not meet the requirements of the service (e.g., Operand from Prohibited range).
0x06	No records found	Error response if a request for reporting records resulted in no records meeting the criteria. When using Op Code 0x04 (Report number of stored records), Op Code 0x05 (Number of stored records response) is used with 0 as the Operand to report that zero records are found.
0x07	Abort unsuccessful	Error response if request for Abort is unsuccessful.
0x08	Procedure not completed	Error response if procedure cannot be completed for any reason that is not covered by another error response in this table.
0x09	Operand not supported	Error response if unsupported Operand is received (e.g., Operand from RFU range).
0x0A	Procedure not applicable	Error response if the procedure cannot be executed because it is not applicable in the current Server Application context.
0xF0	Success	Normal response for successful procedure in Insulin Delivery Service.
All not already defined values with a Hamming distance of 4 bits to 0xF0	RFU	All not already defined values with a Hamming distance of 4 bits to Response Code Value of *Success* = 0xF0 are reserved for future use.
All other values	Prohibited	Values not having a Hamming distance of 4 bits to Response Code Value of *Success* = 0xF0 shall not be defined and are prohibited.

Table 3.27: IDD RACP Response Code Values

3.9.4　IDD Record Access Control Point behavioral description

The IDD Record Access Control Point controls notifications of the IDD History Data characteristic values and other data operations. Procedures are triggered by a Write to this characteristic value that includes an Op Code specifying the operation (see Table 3.22) and an Operator and Operand that are valid within the context of that Op Code (see Table 3.23). In a multiple-bond case, the handling of the Control Point shall be consistent across all bonds, i.e., there is a single Server history record database that is shared by all Clients.

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-Counter field and an E2E-CRC field shall be included in the IDD Record Access Control Point characteristic.

If E2E-Protection is supported, the Server shall check the E2E-Counter and E2E-CRC and handle errors as defined in Section 3.12.

3.9.4.1　Filter Types

A Filter Type field is defined to enable the flexibility to filter based on different criteria (i.e., Sequence Number, Sequence Number filtered by Reference Time Event, or Sequence Number filtered by Non-Reference Time Event).

All Procedure Operators except *Null* require a Filter Type as part of the Operand. This is used to specify the field in the IDD History Data characteristic value that is used to perform the filtering. When used, the Filter Type byte shall precede the applicable filter parameter(s) within the Operand. For example, when used with the 'within range of' Operator, the Operand has the format
<Filter Type><minimum><maximum>, where Filter Type is the Least Significant Octet of the Operand. See Table 3.24 for a list of valid Filter Type values.

When using a Filter Type, the format of the Operand is the Filter Type followed by the applicable Sequence Number value or value pair depending upon the Operator.

3.9.4.2　Report Number of Stored Records procedure

When the *Report Number of Stored Records* Op Code is written to the IDD Record Access Control Point, the Server shall calculate and respond with a record count in uint32 format based on Filter Type criteria and Operator and Operand values. Refer to Table 3.23 for Operand requirements when used with a specific Operator and note that in some cases, no Operand is used. The record count reported in the response is calculated based on the current state of the Server history record database and may change between connections or after records are cleared. The response is indicated using the *Number of Stored Records Response* Op Code, an Operator of Null, and the Operand set to the record count.

If the Server does not locate any records matching the filter criteria of the request, the Server shall indicate the IDD Record Access Control Point with a *Number of Stored Records Response* Op Code, an Operator of Null, and the Operand set to *0x0000 0000.*

If the operation results in an error condition, this shall be indicated using the *Response Code* Op Code, an Operator of Null, and the appropriate *Response Code Value* in the Operand for the error condition (see Sections 3.9.4.6 and 3.11.4).

3.9.4.3   Delete Stored Records procedure

When the *Delete Stored Records* Op Code is written to the IDD Record Access Control Point, the Server may delete the specified history records based on Operator and Operand values. The history records may be permanently deleted from the Server history database. Refer to Table 3.23 for Operand requirements when used with a specific Operator and note that in some cases, no Operand is used. The Server shall indicate this characteristic with a *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Delete Stored Records, and a *Response Code Value* of *Success* if the records were successfully deleted from the Server history record database.

If the Server does not locate any records matching the Filter Type criteria of the request, the Server shall indicate the IDD Record Access Control Point with a *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Delete Stored Records, and a *Response Code Value* in the Operand set to *No Records Found*.

If a history record is part of a compound event group (see Section 3.10.1), it shall only be deleted if the Operator and Operand include all events within that group. This helps recorded actions (e.g., Bolus Delivered Events) keep all relevant event data. If not all events of a group are included, the Server shall indicate the IDD Record Access Control Point with a *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Delete Stored Records, and a *Response Code Value* in the Operand set to *Procedure not applicable* (see Table 3.27).

If the operation results in an error condition, this shall be indicated using the *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Delete Stored Records, and the appropriate *Response Code Value* in the Operand for the error condition (see Sections 3.9.4.6 and 3.11.4).

3.9.4.4   Report Stored Records procedure

When the *Report Stored Records* Op Code is written to the IDD Record Access Control Point, the Server shall notify the selected set of stored patient records based on the filter criteria specified in the Operator and Operand. Refer to Table 3.23 for Operand requirements when used with a specific Operator and note that in some cases, no Operand is used. The semantics of a record transfer is a 'copy' of the records and not a 'move' of the records.

If during the record transfer a new history record becomes available (i.e., after the Report Stored Records procedure is initiated), the Server may include this new record in the history transfer.

> Note: A profile using this service is required to verify Clients are tolerant of the possibility that additional records will be received than might have been expected.

Once all data records for a given request have been notified by the Server, the Server shall indicate the IDD Record Access Control Point with a *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Report Stored Records, and a *Response Code Value* in the Operand set to *Success*.

If the Server does not locate any records matching the Filter Type criteria of the request, the Server shall indicate the IDD Record Access Control Point with a *Response Code* Op Code, an Operator of Null, *Request Op Code* of Report Stored Records, and a *Response Code Value* in the Operand set to *No Records Found*.

If the operation results in an error condition, this shall be indicated using the *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Report Stored Records, and the appropriate *Response Code Value* in the Operand for the error condition (see Sections 3.9.4.6 and 3.11.4).

If the Server is required to interrupt its data transfer before completion for any reason other than the Abort Operation procedure (see Section 3.9.4.5), the Server shall indicate the IDD Record Access Control Point with a *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Report Stored Records, and a *Response Code Value* in the Operand set to *Procedure not completed*.

3.9.4.5   Abort Operation procedure

When the *Abort Operation* Op Code is written to the IDD Record Access Control Point, the Server shall stop any IDD RACP procedures currently in progress and make a best effort to stop sending any further data.

Once all IDD RACP procedures have been stopped, the Server shall indicate the IDD Record Access Control Point with a *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Abort Operation, and a *Response Code Value* in the Operand set to *Success*.

If the operation results in an error condition, this shall be indicated using the *Response Code* Op Code, an Operator of Null, a *Request Op Code* of Abort Operation, and the appropriate *Response Code Value* in the Operand for the error condition (see Sections 3.9.4.6 and 3.11.4).

3.9.4.6   IDD RACP specific errors

If the Filter Type within an Operand that was written to the IDD RACP characteristic is not supported by the Server or is an RFU value, the Server shall indicate the IDD RACP with a *Response Code* Op Code, an Operator of Null, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Operand not supported*.

If the Server is unable to process the Abort Operation procedure for any reason not stated here, the Server shall indicate the IDD RACP with a *Response Code* Op Code, an Operator of Null, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Abort unsuccessful.*

If the Operator that was written to the IDD RACP is not supported by the Server or is an RFU value, the Server shall indicate the IDD RACP with a *Response Code* Op Code, an Operator of Null, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Operator not supported*.

If the Operator that was written to the IDD RACP is supported by the Server but is not applicable for the used Op Code, the Server shall indicate the IDD RACP with a *Response Code* Op Code, an Operator of Null, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Invalid Operator*.

If the Op Code that was written to the IDD RACP requires notifications of the IDD History Data characteristic and its Client Characteristic Configuration descriptor is not configured for notifications, the Server shall return an error response with the Attribute Protocol Application error code set to *Client Characteristic Configuration Descriptor Improperly Configured*.

If a request with an Op Code other than *Abort Operation* is written to the IDD RACP while the Server is performing a previously triggered IDD RACP operation (i.e., resulting from invalid Client behavior), the

Server shall return an error response with the Attribute Protocol Application error code set to *Procedure Already In Progress.*

3.10   IDD History Data

The IDD History Data characteristic is composed of response records from executed procedures of the IDD Record Access Control Point.

3.10.1   Compound event groups

The IDD History Data characteristic value is composed of a history event of a specific type. There are several event types that belong to a group of events. Each group describes a specific compound event in the history and shall be stored by the Server in several history records with different event types of that group to fit the default MTU size.

The events of the same group shall be recorded in a sequence with increased Sequence Number field values (increased by 1 after each event) and the same Relative Offset field value (i.e., the events of the same group have the same time stamp).

Table 3.28 shows the different groups of compound events and the recording order of the contained history events:

Compound Event Group	Required Events and their Order (Event Types as specified in IDD History Data)
Bolus Calculated	Bolus Calculated Part 1 of 2 Bolus Calculated Part 2 of 2
Bolus Programmed	Bolus Programmed Part 1 of 2 Bolus Programmed Part 2 of 2
Bolus Delivered	Bolus Delivered Part 1 of 2 Bolus Delivered Part 2 of 2
TBR Adjustment Started	TBR Adjustment Started Delivered Basal Rate Changed
TBR Adjustment Ended	TBR Adjustment Ended Delivered Basal Rate Changed
TBR Adjustment Changed	TBR Adjustment Changed Delivered Basal Rate Changed
Basal Rate Profile Template Changed	Sequence of Basal Rate Profile Template Time Block Changed events. Each event is composed of a single time block of the Basal Rate Profile Template. The Server shall record the full profile. Therefore, the number of events within this group always corresponds to the number of time blocks of the changed basal rate profile template. Also see Section 3.10.3.

Compound Event Group	Required Events and their Order (Event Types as specified in IDD History Data)
ISF Profile Template Changed	Sequence of ISF Profile Template Time Block Changed events. Each event is composed of a single time block of the ISF Profile Template. The Server shall record the full profile. Therefore, the number of events within this group always corresponds to the number of time blocks of the changed ISF profile template. Also see Section 3.10.3.
I:CHO Ratio Profile Template Changed	Sequence of I2CHO Ratio Profile Template Time Block Changed events. Each event is composed of a single time block of the I:CHO Ratio Profile Template. The Server shall record the full profile. Therefore, the number of events within this group always corresponds to the number of time blocks of the changed I:CHO ratio profile template. Also see Section 3.10.3.
Target Glucose Range Profile Template Changed	Sequence of Target Glucose Range Profile Template Time Block Changed events. Each event is composed of a single time block of the Target Glucose Range Profile Template. The Server shall record the full profile. Therefore, the number of events within this group always corresponds to the number of time blocks of the changed target glucose range profile template. Also see Section 3.10.3.
Annunciation Status Changed	Annunciation Status Changed Part 1 of 2 Annunciation Status Changed Part 2 of 2
Bolus Template Changed	Bolus Template Changed Part 1 of 2 Bolus Template Changed Part 2 of 2

Table 3.28: Compound event groups of IDD History Data Event Types

3.10.2   Recording criteria of events

Table 3.29 shows the criteria when events of a specific type are recorded by the Server:

Event Type	Event Recording Criteria
Reference Time	The Reference Time event is an absolute time stamp referenced by all event types by their Relative Offset field. This event shall be used by the Server if the Insulin Delivery Device uses absolute time (i.e., in that case, the Reference Time Base Offset event shall not be used). It should be recorded:

Event Type	Event Recording Criteria
	• As very first event in history (e.g., factory setting) • If the Date Time, Time Zone, or Daylight Saving Time (DST) Offset of the Insulin Delivery Device is changed • If the data type limit of the Relative Offset field is reached (i.e., each 65535 s at the latest) Note: This event should be recorded periodically (e.g., each full hour). See examples in Sections D.1 and D.2.
Reference Time Base Offset	The Reference Time Base Offset event is a Base Offset time stamp referenced by all event types by their Relative Offset field. This event shall be used by the Server if the Insulin Delivery Device uses base offset time (i.e., in that case, the Reference Time event shall not be used). It should be recorded: • As very first event in history (e.g., factory setting) • If the Base Time or Time Offset of the Insulin Delivery Device is changed • If the data type limit of the Relative Offset field is reached (i.e., each 65535 s at the latest) Note: This event should be recorded periodically (e.g., each full hour).
Bolus Calculated Part 1 of 2[1] Bolus Calculated Part 2 of 2[1]	The Bolus Calculation events should be recorded if a Bolus is calculated by a Bolus Calculator within the application of the Insulin Delivery Device.
Bolus Programmed Part 1 of 2[1] Bolus Programmed Part 2 of 2[1]	The Bolus Programmed events should be recorded if a Bolus is programmed on the Insulin Delivery Device or via a Client (i.e., procedure *Set Bolus* is executed on the IDD Command CP). See example in Section D.3.
Bolus Delivered Part 1 of 2[1] Bolus Delivered Part 2 of 2[1]	The Bolus Delivered events should be recorded if the delivery of bolus is terminated (i.e., the programmed amounts including the extended amount of an extended or multiwave bolus has been delivered completely or partly if the bolus was canceled by the user or due to an error).

Event Type	Event Recording Criteria
	See example in Section D.3.
Delivered Basal Rate Changed	This event should be recorded in every case that affects the delivery of the basal rate (e.g., a new time block in the basal rate profile is entered; the basal rate profile is reconfigured; a TBR starts, changes, or stops; the Therapy Control State of the device changes from Run to another state or vice versa).
TBR Adjustment Started[2]	This event should be recorded if a TBR is started via the Insulin Delivery Device or via a Client (i.e., procedure *Set TBR Adjustment* is executed on the IDD Command CP with *Change TBR* bit set to *False*). See example in Section D.4.
TBR Adjustment Ended[2]	This event should be recorded if a TBR ended (i.e., end of programmed duration or canceled). See example in Section D.4.
TBR Adjustment Changed[2]	This event should be recorded if an active TBR is changed via the Insulin Delivery Device or via a Client (i.e., procedure *Set TBR Adjustment* is executed on the IDD Command CP with *Change TBR* bit set to 1). See example in Section D.4.
Profile Template Activated	This event should be recorded if any profile template is activated via the Insulin Delivery Device or via a Client (i.e., procedure *Activate Profile Templates* is executed on the IDD Command CP). If a profile template was not activated previously, the Server shall set the Old Profile Template Number field to 0.
Basal Rate Profile Template Time Block Changed	See common recording criteria of profile changed events in Section 3.10.3 and example in Section D.5.
Total Daily Insulin Delivery	This event should be recorded at midnight determined by the date time of the Insulin Delivery Device. Note: The time stamp of this event may have another date than the day the event is recorded for (i.e., the patient changed the date of the Insulin Delivery Device). If the date time was changed and this event is recorded, the Server shall set the *Date*

Event Type	Event Recording Criteria
	Time Changed Warning bit of the Flags field to *True*.
Therapy Control State Changed	This event should be recorded with each change of the therapy control state of the Insulin Delivery Device.
Operational State Changed	This event should be recorded with each change of the operational state of the Insulin Delivery Device.
Reservoir Remaining Amount Changed	This event should be recorded with each change of the remaining amount of the reservoir. The frequency of recording this event is implementation specific.
Annunciation Status Changed Part 1 of 2[1] Annunciation Status Changed Part 2 of 2[1]	The Annunciation Status Changed events should be recorded if a new annunciation is reported. Also see Section 3.4.1.6 for requirements in context of annunciations of type *Temperature*.
ISF Profile Template Time Block Changed	See common recording criteria of profile changed events in Section 3.10.3
I2CHO Ratio Profile Template Time Block Changed	See common recording criteria of profile changed events in Section 3.10.3
Target Glucose Range Profile Template Time Block Changed	See common recording criteria of profile changed events in Section 3.10.3
Priming Started	This event should be recorded if the priming of the Insulin Delivery Device is started (e.g., by executing the *Start Priming* procedure on the IDD Command CP, see Section 3.7.2.21).
Priming Done	This event should be recorded if the priming of the Insulin Delivery Device is terminated (i.e., aborted by the user, the programmed insulin amount for the priming was delivered completely, or an error occurred that stopped the priming).
Data Corruption	If the Insulin Delivery Device detects corrupt events in the history memory, a Data Corruption event should be inserted (e.g., if the E2E-CRC is wrong). If this event is recorded, the Server shall set its Sequence Number to *0xFFFF FFFF*. Note: If the Client reads a Data Corruption event from the Server, it can detect that the data corruption (e.g., wrong E2E-CRC) occurred on the Insulin Delivery Device. If the Server does not use the Data Corruption event and just sends an event

Event Type	Event Recording Criteria
	with a wrong E2E-CRC, the Collector cannot determine if the data corruption was on the Insulin Delivery Device or somewhere else (e.g., on a Bluetooth dongle connected to a PC).
Pointer Event	This event is a placeholder to align the history events exposed by the IDD RACP with the events of a possible proprietary manufacturer History CP in the case that the absolute time stamp of those events are equal (i.e., the aligned events can have continuous Sequence Numbers even if a proprietary History CP uses its own Sequence Numbers).
Bolus Template Changed Part 1 of 2 Bolus Template Changed Part 2 of 2	This event should be recorded if the settings of a bolus template are changed via the Insulin Delivery Device or via a Client (i.e., procedure *Set Bolus Template* is executed on the IDD Command CP).
TBR Template Changed	This event should be recorded if the settings of a TBR template are changed via the Insulin Delivery Device or via a Client (i.e., procedure *Set TBR Template* is executed on the IDD Command CP).
Max Bolus Amount Changed	This event should be recorded if the setting of the maximum bolus amount was changed via the Insulin Delivery Device or via a Client (i.e., procedure *Set Max Bolus Amount* is executed on the IDD Command CP).

Table 3.29: Recording criteria of events

[1] The event is split in two parts and the second part is mandatory if the first part is recorded. Part two shall have the Sequence Number of the first part increased by 1. Both events shall have the same Relative Offset value (see Section 3.10.1).

[2] This event shall have a corresponding *Delivered Basal Rate Changed* event with a Sequence Number of this event increased by 1. Both events shall have the same Relative Offset value (see Section 3.10.1).

3.10.3 Common recording criteria of profile change events

This section defines the common recording criteria for the following profile change events:

- Basal Rate Profile Template Time Block Changed

- ISF Profile Template Time Block Changed

- I2CHO Ratio Profile Template Time Block Changed

- Target Glucose Range Profile Template Time Block Changed

An event of the type above shall be recorded in a sequence for all time blocks if any setting of a specific profile is changed via the Server or via a Client (e.g., procedure *Write Basal Rate Profile Template* is executed on the IDD Command CP):

- The events shall have the same Relative Offset value

- An event belonging to the same profile shall have a Sequence Number of the previous event of this profile incremented by 1

- The Server shall always record the full profile (i.e., not just the changed time blocks) and therefore the sum of all time block durations shall be 24 hours

3.10.4 Characteristic behavior

When the *Client Characteristic Descriptor* of the IDD History Data characteristic is configured for notifications, the IDD Record Access Control Point shall be used to control notifications of this characteristic.

The IDD History Data characteristic contains time-sensitive data, thus the requirements for time-sensitive data and data storage defined in Section 3.13 apply.

3.10.4.1 Event Type field

The Event Type field shall be included in the IDD History Data characteristics.

The Event Type field describes the type of event that belongs to a history record.

3.10.4.2 Sequence Number field

The Sequence Number field shall be included in the IDD History Data characteristics.

The Sequence Number is an unsigned 32-bit integer, which shall be assigned to each IDD History Data characteristic value to maintain the chronological order of the history records in the Server history database. The initial default value shall be *0x0000 0000*. The use of a Reference Time Event and Relative Offset for this purpose cannot be relied upon due to the potential for user induced date and time errors or catastrophic time based errors that may occur due to a battery failure.

The last Sequence Number used should be stored in non-volatile memory to keep a continuum in case of a reset or battery failure. In addition, the Sequence Number shall not be reset back to the default when the database is cleared through the Delete Stored Records procedure, as discussed in Section 3.9.4.3.

The Sequence Number shall be incremented by 1 for each successive IDD History Data characteristic value. The maximum value for Sequence Number permitted is *0xFFFF FFFF*. Assuming up to 1500 history events per month, the maximum value of the Sequence Number would be reached in about 238 K years. Since product life expectancy of an Insulin Delivery Device is about 5 years (i.e., about 90 K history events), this value significantly exceeds that expectation. This value is not permitted to roll over, although a reset of the Sequence Number back to zero might occur due to non-volatile memory failure or other catastrophic hardware or software errors within the Sensor.

Note that some gaps in sequence numbers may exist in the internal storage of a Server in some situations. For example, this can occur if the user locally deleted one or more entries at the user interface or if a Client deleted some entries using the Delete Stored Records command via the IDD Record Access Control Point.

Note that the value of a sequence number in the IDD History Data characteristic shall not be changed due to for example, patient record deletions or other actions.

3.10.4.3 Relative Offset field

The Relative Offset field shall be included in the IDD History Data characteristics.

The Relative Offset field is defined as an unsigned 16-bit integer and represents the elapsed time in seconds since the last recorded Reference Time event. The Relative Offset value shall be *0x0000* if the date time of the Insulin Delivery Device was set for the very first time or has been lost (e.g., due to a battery replacement or a battery failure).

The Relative Offset field is used in conjunction with the last recorded Reference Time event to represent the absolute date time of this history record. This absolute date time of the history record is the sum of the date time stored within the Event Data field of the latest Reference Time event and the Relative Offset field.

3.10.4.4 Event Data field

The Event Data field shall be included in the IDD History Data characteristic.

The Event Data field is composed of the event data depending on the specific event type of the Event Type field.

3.10.4.5 E2E-CRC field (optional)

If the device supports E2E-Protection (*E2E-Protection Supported* bit is set in Flags field of IDD Features), an E2E-CRC field shall be included in the IDD History Data characteristic.

An E2E-Counter field shall not be included because the Sequence Number field of this characteristic meets the same requirements.

3.11 Common behavior of CPs (IDD Status Reader CP, IDD Command CP, IDD RACP)

3.11.1 Sequential processing of procedures

If a CP procedure is running and the Client executes another procedure on any CP of this service except the Abort Operation Procedure of the IDD RACP, the Server shall return an error response with the Attribute Protocol Application error code set to *Procedure Already in Progress* (Also see Section 3.9.4.6).

3.11.2 Common transaction behavior

A transaction is a sequence of CP procedures of the same Op Code and is started with the first write to a CP and ends with the indication of the last CP procedure. That last CP procedure is identified by the End of Transaction flag. Transactions are used in the context of writing profile templates (see Section 3.7.2.1.2). There can only be one transaction at the same time and transactions are independent from each other (i.e., all successful transactions prior to a failed transaction are completed and therefore the Server shall let them remain unaffected). If a transaction fails (e.g., due to a failed plausibility check of the Server) or is interrupted by a different CP procedure on any CP of this service (e.g., if a running bolus is

canceled by the Client while writing a basal rate profile template), the Server shall discard all data of the transaction and end the transaction.

3.11.3   Procedure timeout

In the context of the Control Point characteristic, a procedure is started when a write to the Control Point characteristic is successfully completed. When a procedure is complete, the Server indicates the Control Point characteristic with the Op Code set to the corresponding *Response Code*, and the *Request Op Code* and the *Response Code Value* or the Op Code is set to the corresponding response Op Code of the procedure followed by a response data record.

A CP procedure may consist of multiple characteristic notifications (e.g., notifications of IDD Command Data or IDD History Data) followed by an indication of the Control Point characteristic. When the Server transmits an indication of the Control Point characteristic, the response is considered to have timed out if the acknowledgement is not received within the ATT transaction timeout, defined as 30 seconds in Volume 3 Part F Section 3.3.3 of [1]. If a timeout occurs, the Server shall stop sending any further indications and notifications related to the operation and consider the procedure to have failed.

3.11.4   General error handling procedures

Other than error handling procedures that are specific to certain Op Codes, the following apply:

- If an Op Code is written to the Control Point characteristic and the Client Characteristic Configuration descriptor of the Control Point is not configured for indications, the Server shall return an error response with the Attribute Protocol Application error code set to *Client Characteristic Configuration Descriptor Improperly Configured*.

- If the Op Code that was written to the Control Point characteristic is unsupported by the Server (e.g., the procedure refers to a feature that is not supported by the Server, or the Op Code is an RFU value), the Server shall indicate the Control Point with a *Response Code* Op Code, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Op Code not supported*.

- If the Operand that was written to the Control Point characteristic contains at least one invalid field (e.g., invalid structure, field with RFU value, or field value is not supported by the Server, etc.), the Server shall indicate the Control Point with a *Response Code* Op Code, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Invalid Operand*.

- If the Server could not execute a procedure because it was not applicable in the current Server Application context, the Server shall indicate the Control Point with a *Response Code* Op Code, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Procedure not applicable*.

- If the Server was unable to complete a procedure for any other reason than those described above, the Server shall indicate the Control Point with a *Response Code* Op Code, the appropriate *Request Op Code*, and a *Response Code Value* in the Operand set to *Procedure not completed*.

3.12 Server behavior in case of E2E-Errors

If a Client writes to a control point and the Server supports E2E-Protection, the Server shall check the received E2E-Counter value (see Section 3.1.1 and if it is missing or invalid, the Server shall indicate the control point with an Attribute Protocol Application error code set to *Invalid Counter* as Response Code Value (see Section 1.8).

If a Client writes to a control point and the Server detects an error in the CRC calculation (see Section 3.1.2), it shall return an error response with the Attribute Protocol Application error code set to *Invalid CRC.*

3.13 Requirements for time-sensitive data

The IDD History Data characteristic is a time-sensitive characteristic value. For this characteristic value, the following requirements and recommendations apply:

- The Server should be able to store several thousand history records.

- If the maximum storage capacity in the Server is reached, the Server should overwrite the oldest records first when acquiring new records.

- When transmitting stored data, the oldest data shall be sent first followed by the next oldest data (in FIFO order) until all stored data (as requested by the Client) has been transferred.

3.14 Special short float value requirements

IEEE 11073-20601 [3] defines the short floating point data type. The value *Not a Number* (*NaN)* is used to report an invalid result from a computation step.

3.15 E2E Counter check

A received E2E-Counter value within an E2E-Counter field (see Section 3.1.1) can be used by the Server and Client to detect an out of sequence message by evaluating the following condition:

$$Current\ Received\ E2E{-}Counter\ Value - (Last\ Received\ E2E{-}Counter\ Value\ mod\ 255) = 1$$

3.16 E2E-CRC calculation

The E2E-CRC, hereafter referred to as the CRC, is defined using a CRC-CCITT generator polynomial $g(D){=}D^{16}{+}D^{12}{+}D^{5}{+}1$ (i.e., 210041 in octal representation) .The calculation is done in the same way as specified in Volume 2, Part B, Section 7.1.2 in [1], but instead of the UAP the seed of *0xFFFF* shall be used.

The CRC shift register shall be filled with 1s before calculating the CRC. Octets shall be fed through the CRC generator least significant bit first.

The most significant parity octet shall be transmitted first (where the CRC shift register is viewed as shifting from the least significant bit towards the most significant bit). Therefore, the transmission order of the parity octets within the CRC shift register is as follows:

x[8], x[9], …, x[15], x[0], x[1]…; x[7] (last)

where x[15] corresponds to the highest power CRC coefficient and x[0] corresponds to the lowest power coefficient. The switch shall be set in position 1 while the data is shifted in. After the last bit has entered the Linear Feedback Shift Register (LFSR), the switch (S) shall be set in position 2, and the register contents shall be read out.

D_0 D_5 D_{12} S   2 D_{16} 1

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
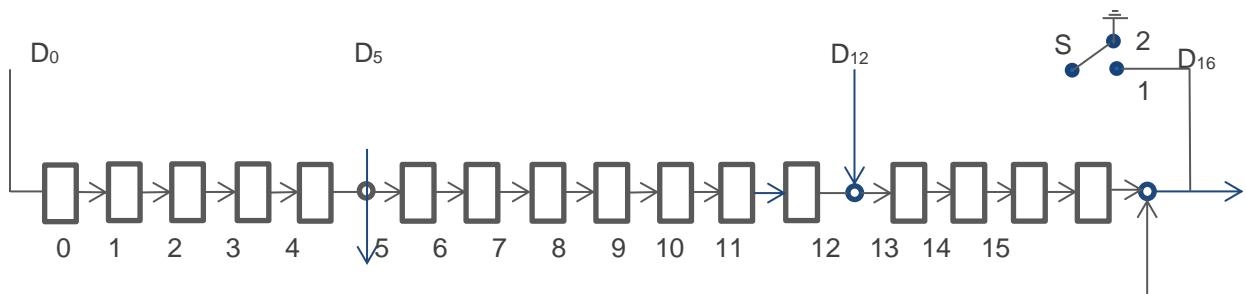
Figure 3.1: LFSR Circuit generating the CRC

The computation for a sample with 10 bytes of data is the following:

data[0] = 0x3E
data[1] = 0x01
data[2] = 0x02
data[3] = 0x03
data[4] = 0x04
data[5] = 0x05
data[6] = 0x06
data[7] = 0x07
data[8] = 0x08
data[9] = 0x09

➔ CRC[0] = 0x01
    CRC[1] = 0x2F

Note: Also see Volume 2, Part B, Section 7.1.2 in [1] for more details. For E2E-CRC, the Linear Feedback Shift Register is initially loaded with a seed of *0xFFFF* instead of the UAP and the calculation is done in the same way.

4 Characteristic information

The following characteristics are related to the Insulin Delivery Service.

4.1 IDD Status Changed

The IDD Status Changed characteristic is identified using the UUID «IDD Status Changed», as defined in [2].

The IDD Status Changed characteristic contains status changes of the Insulin Delivery Device and the insulin therapy comprising a Flags field, an optional E2E-Counter field, and an optional E2E-CRC field.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	16 bit	2	None	LSO…MSO
E2E-Counter	C.1	uint8	1	N/A	N/A
E2E-CRC	C.1	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.1: IDD Status Changed Record

C.1: Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

4.1.1 Flags field

Flags fit Bit	Definition	Description
0	Therapy Control State Changed	If this bit is set, the therapy control state of the Insulin Delivery Device changed.
1	Operational State Changed	If this bit is set, the operational state of the Insulin Delivery Device changed.
2	Reservoir Status Changed	If this bit is set, the status of the insulin reservoir changed (caused by a reservoir change or the delivery of insulin).

Flags fit Bit	Definition	Description
3	Annunciation Status Changed	If this bit is set, a new annunciation was created by the Server application.
4	Total Daily Insulin Status Changed	If this bit is set, the total daily insulin amount changed due to a bolus or basal delivery. The bit shall be set at the end of an effective delivery.
5	Active Basal Rate Status Changed	If this bit is set, the current basal rate changed due to a new basal rate value (e.g., caused by a changed basal rate profile, reaching of a time block with another basal rate value or by a TBR).
6	Active Bolus Status Changed	If this bit is set, a new bolus was initiated or the status of current Active Bolus changed.
7	History Event Recorded	If this bit is set, a new event has been recorded in the history.
All other bits	RFU	None

Table 4.2: IDD Status Changed Flags

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.2   IDD Status

The IDD Status characteristic is identified using the UUID «IDD Status», as defined in [2].

The IDD Status characteristic contains status values of the Insulin Delivery Device and the insulin therapy comprising an optional E2E-Counter field and an optional E2E-CRC field.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Therapy Control State	M	Enumeration of uint8	1	None	N/A
Operational State	M	Enumeration of uint8	1	None	N/A

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Reservoir Remaining Amount	M	SFLOAT	2	IU	LSO…MSO
Flags	M	8 bit	1	None	N/A
E2E-Counter	C.1	uint8	1	N/A	N/A
E2E-CRC	C.1	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.3: IDD Status record

C.1: Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

4.2.1 Therapy Control State field

The Therapy Control State field describes the therapy state of the Insulin Delivery Device.

4.2.1.1 Therapy Control State values

The following values are defined for the Therapy Control State field:

Description	Value	Meaning
Undetermined	0x0F	The operational state is undetermined.
Stop	0x33	The insulin infusion therapy is stopped but the Insulin Delivery Device can still be configured (e.g., priming).
Pause	0x3C	The insulin infusion therapy is paused (i.e., the device does not deliver insulin related to the therapy but delivers the missed amount of insulin after leaving state Pause and entering state Run). Typically the Pause state is limited to several minutes and can be used, for example, to bridge the time during a reservoir change.

Description	Value	Meaning
Run	0x55	The insulin infusion therapy is running (i.e., the device delivers insulin related to the therapy). The Insulin Delivery Device cannot be configured in the Run state (e.g., priming).
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.4: Therapy Control State values

4.2.2 Operational State field

The Operational State field represents the operational state of the Insulin Delivery Device in the context of running an insulin infusion therapy.

4.2.2.1 Operational State values

The following values are defined for the Operational State field:

Description	Value	Meaning
Undetermined	0x0F	The operational state is undetermined.
Off	0x33	The Insulin Delivery Device is switched off and no functionality is available (i.e., no delivery and no configuration is possible).
Standby	0x3C	No insulin is delivered and resuming from this state is faster than from state Off (e.g., the device is being set to a state to save energy).
Preparing	0x55	The Insulin Delivery Device prepares the insulin infusion therapy. For example, the Insulin Delivery Device rewinds the piston rod to enable the insertion of a new reservoir or performs a sniffing by detecting the position of the plunger in the reservoir (related to insulin pumps with cartridge).
Priming	0x5A	The Insulin Delivery Device fills the fluidic path from the reservoir to the body with insulin (e.g., after replacement of the reservoir and/or infusion set).
Waiting	0x66	The Insulin Delivery Device waits for an interaction (e.g., waiting for the infusion set to be connected to the body after priming or waiting for a user confirmation of a reported error).
Ready	0x96	The Insulin Delivery Device is ready for the insulin infusion therapy.

Description	Value	Meaning
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.5: Operational State values

4.2.3 Reservoir Remaining Amount field

The Reservoir Remaining Amount field represents the remaining amount of insulin in the reservoir in IU as an SFLOAT data type defined in [3].

4.2.4 Flags field

Bit	Definition	Description
0	Reservoir Attached	If this bit is set, the reservoir is attached to the Insulin Delivery Device.
All other bits	RFU	None

Table 4.6: IDD Status Flags

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.3 IDD Annunciation Status

The IDD Annunciation Status characteristic is identified using the UUID «IDD Annunciation Status», as defined in [2].

The IDD Annunciation Status characteristic is a variable length structure comprising of a Flags field, the annunciation information, optional up to five auxiliary information fields describing annunciation details, and is closed by an optional E2E-Counter field and E2E-CRC field.

The presence of the AuxInfo fields depends on the Flags field value.

The minimum length of the IDD Annunciation Status record is 1 octet and the maximum length is 19 octets.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Annunciation Instance ID	C.1	uint16	2	None	LSO…MSO
Annunciation Type	C.1	Enumeration of uint16	2	None	LSO…MSO
Annunciation Status	C.1	Enumeration of uint8	1	None	N/A
AuxInfo1	C.1	Binary Object	2	None	LSO…MSO
AuxInfo2	C.1	Binary Object	2	None	LSO…MSO
AuxInfo3	C.1	Binary Object	2	None	LSO…MSO
AuxInfo4	C.1	Binary Object	2	None	LSO…MSO
AuxInfo5	C.1	Binary Object	2	None	LSO…MSO
E2E-Counter	C.2	uint8	1	N/A	N/A
E2E-CRC	C.2	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.7: IDD Annunciation Status Record

C.1: Mandatory if field is indicated via Flags field, otherwise excluded.
C.2: Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

4.3.1 Flags field

The Flags field signals the presence of the Annunciation and AuxInfo fields. The bits of the Flags field are defined as follows:

Bit	Definition	Description
0	Annunciation Present	If this bit is set, the fields Annunciation Instance ID, Annunciation Type, and Annunciation Status are present (i.e., there is a currently active or already confirmed annunciation). This bit shall not be set if there has not been an annunciation yet.
1	AuxInfo1 Present	If this bit is set, the AuxInfo1 field is present.
2	AuxInfo2 Present	If this bit is set, the AuxInfo2 field is present.
3	AuxInfo3 Present	If this bit is set, the AuxInfo3 field is present.
4	AuxInfo4 Present	If this bit is set, the AuxInfo4 field is present.
5	AuxInfo5 Present	If this bit is set, the AuxInfo5 field is present.
All other bits	RFU	None

Table 4.8: IDD Annunciation Status Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.3.2 Annunciation Instance ID field

The Annunciation Instance ID field represents a unique identifier as a uint16 data type created by the Server application for all annunciations that occur in the course of time.

4.3.3 Annunciation Type field

The Annunciation Type field describes the kind of annunciation in the scope of the Server application as a uint16 data type.

4.3.3.1 Annunciation Type values

The following values are defined for the Annunciation Type field:

Description	Value	Meaning
System Issue	0x000F	A general device fault or system error occurred (e.g., electronical or software error).
Mechanical Issue	0x0033	A mechanical error occurred.
Occlusion Detected	0x003C	An occlusion occurred (e.g., clogging of infusion set).
Reservoir Issue	0x0055	An error related to the replacement or functioning of the reservoir occurred.
Reservoir Empty	0x005A	The reservoir is empty.
Reservoir Low	0x0066	The reservoir fill level reached a defined low threshold.
Priming Issue	0x0069	There is a priming issue after replacement of reservoir and/or infusion set (e.g., infusion set has not been primed).
Infusion Set Incomplete	0x0096	The physical connection between infusion set (including tubing and/or cannula) and the Insulin Delivery Device is incomplete.
Infusion Set Detached	0x0099	The infusion set (including tubing and/or cannula) is not attached to the body.
Power Source Insufficient	0x00A5	The Insulin Delivery Device has insufficient power to charge the device (i.e., the device cannot properly function).
Battery Empty	0x00AA	The Insulin Delivery Device has no operational runtime left. The user shall be informed.
Battery Low	0x00C3	The Insulin Delivery Device has a low operational runtime (e.g., the battery charge level reached a defined low threshold, the battery is depleted, or the battery voltage is less than full strength). The user shall be informed.
Battery Medium	0x00CC	The Insulin Delivery Device has a medium operational runtime. This annunciation should be reported at half of the operational runtime.
Battery Full	0x00F0	The Insulin Delivery Device has a full operational runtime. This annunciation should be reported at full operational runtime.
Temperature out of range	0x00FF	The temperature is outside of the normal operating range.
Air pressure out of range	0x0303	The air pressure is outside of the normal operating range (e.g., altitude).

Description	Value	Meaning
Bolus Canceled	0x030C	A running bolus was canceled (e.g., Insulin Delivery Device changed from run to standby mode).
TBR Over	0x0330	The temporary basal rate expired (i.e., the programmed duration is over).
TBR Canceled	0x033F	The temporary basal rate canceled (e.g., device changed from run to standby mode).
Max Delivery	0x0356	The delivery reached a defined high threshold based on maximum bolus and maximum basal rates.
Date Time Issue	0x0359	The date time of the device was never set or has been lost (e.g., due to a battery replacement).
Temperature	0x0365	The Insulin Delivery Device reports a temperature measurement.
Manufacturer Reserved Hamming Code Value Range[1]	0xF000 – 0xFFF0	All Hamming codes values in the range of 0xF000 and 0xFFF0 are manufacturer reserved. All non-Hamming codes values within this range are prohibited.
RFU	All not already defined Hamming code values within 0x0000 and 0xFFFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x0000 and 0xFFFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.9 Annunciation Type values

[1] The Manufacturer Reserved range of Annunciation Types Values shall be used by manufacturers of Insulin Delivery Devices to define custom annunciations in addition to the already defined values. This value range is based on the private range for code blocks or partitions as defined in [5]. All non-Hamming codes values within this range are prohibited.

4.3.4   Annunciation Status field

The Annunciation Status field represents the current status of an annunciation.

4.3.5   Annunciation Status values

The following values are defined for the Annunciation Status field:

Description	Value	Meaning
Undetermined	0x0F	The status of the annunciation is undetermined.
Pending	0x33	The annunciation is currently pending and requires a user action for snoozing or confirmation.

Description	Value	Meaning
Snoozed	0x3C	The annunciation was noticed by the user and is set to pop up again at a short time later (i.e., a snoozed annunciation is still active). The time span shall be defined by the Server application.
Confirmed	0x55	The annunciation was confirmed by the user (i.e., a confirmed annunciation is not active anymore).
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.10: Annunciation Status values

4.3.6 AuxInfo fields

There are up to 5 optional auxiliary information fields to describe details of an annunciation (e.g., to display additional information to the user, such as the remaining amount of insulin in case of a low reservoir level). The data type of the AuxInfo fields is a binary object with a size of 2 octets. The underlying data and data format of these fields are defined by the Server application.

4.4 IDD Features

The IDD Features characteristic is identified using the UUID «IDD Features», as defined in [2].

The IDD Features characteristic exposes the supported features of the Insulin Delivery Device, which is composed of an E2E-CRC field, E2E-Counter field, Insulin Concentration field, and a Flags field.

The structure of the IDD Features characteristic is defined below:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
E2E-CRC[1]	M	uint16	2	N/A	LSO…MSO
E2E-Counter[1]	M	uint8	1	N/A	N/A
Insulin Concentration	M	SFLOAT	2	IU/mL	LSO…MSO
Flags	M	24 bit	3	None	LSO…MSO
MSO ↑					

Table 4.11: IDD Features record

[1] The E2E-CRC field shall be set to 0xFFFF and the E2E-Counter to 0 if the *E2E-Protection Supported* bit of the Flags field is not set.

4.4.1   Insulin Concentration field

The Insulin Concentration field represents the concentration of insulin in the reservoir information to identify the insulin concentration of the Insulin Delivery Device. The unit of insulin concentration is international unit per milliliter (IU/mL). For example, U100 designates an insulin concentration of 100 international unit per milliliter of insulin solution.

4.4.2   Flags field

Bit	Definition	Description
0	E2E-Protection Supported	If this bit is set, an E2E-Protection is attached to all characteristics.
1	Basal Rate Supported	If this bit is set, the Insulin Delivery Device supports the delivery of a basal rate including support for profile templates to define different basal rate profiles.
2	TBR Absolute Supported	If this bit is set, the Insulin Delivery Device supports an absolute temporary basal rate in IU/h.
3	TBR Relative Supported	If this bit is set, the Insulin Delivery Device supports a relative temporary basal rate expressed by a dimensionless scaling factor.
4	TBR Template Supported	If this bit is set, the Insulin Delivery Device supports templates to define different TBRs with preset values.
5	Fast Bolus Supported	If this bit is set, the Insulin Delivery Device has the capability to deliver fast boluses.
6	Extended Bolus Supported	If this bit is set, the Insulin Delivery Device has the capability to deliver extended boluses.
7	Multiwave Bolus Supported	If this bit is set, the Insulin Delivery Device has the capability to deliver multiwave boluses.
8	Bolus Delay Time Supported	If this bit is set, the Insulin Delivery Device supports a bolus delay time in minutes.
9	Bolus Template Supported	If this bit is set, the Insulin Delivery Device supports templates to define boluses (of same or different type) with preset values.

Bit	Definition	Description
10	Bolus Activation Type Supported	If this bit is set, the Insulin Delivery Device supports a bolus activation type, which provides additional information about the source, and if possible, the determination of the bolus amount.
11	Multiple Bond Supported	If this bit is set, the Insulin Delivery Device supports multiple bonded devices.
12	ISF Profile Template Supported	If this bit is set, the Insulin Delivery Device supports profile templates to define different ISF profiles.
13	I2CHO Ratio Profile Template Supported	If this bit is set, the Insulin Delivery Device supports profile templates to define different I:CHO Ratio profiles.
14	Target Glucose Range Profile Template Supported	If this bit is set, the Insulin Delivery Device supports target glucose range profile templates to define different target glucose range profiles.
15	Insulin On Board Supported	If this bit is set, the Insulin Delivery Device enables Clients to get the current insulin on board.
23	Feature Extension	If the *Feature Extension* bit is set, an additional octet is attached (bits 24 … 31), where bit 31 shall be used as *Feature Extension* bit in the same way. If this bit is set, then another octet is attached (bits 32 … 39) and so on. This is defined to allow future extension of the characteristic.
All other bits	RFU	None

Table 4.12: IDD Features Flags

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.5   IDD Status Reader Control Point

The IDD Status Reader Control Point is identified using the UUID «IDD Status Reader Control Point», as defined in [2].

This control point is used with a service to provide the ability to read detailed therapy relevant status information from an Insulin Delivery Device.

The structure of the IDD Status Reader Control Point is defined below:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Op Code (see Op Code Values in Table 4.14)	M	Enumeration of uint16	2	None	LSO…MSO
Operand (value defined per Service)	M	Variable	0 to 15	None	LSO…MSO
E2E-Counter	C.1	uint8	1	N/A	N/A
E2E-CRC	C.1	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.13: IDD Status Reader Control Point

C.1: Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

4.5.1 Op Codes

The Op Code values from *0x0303 - 0x0F3C* are reserved for the IDD Status Reader CP to allow 100 Op Codes with Hamming distance of 4. Other Control Points in the context of the Insulin Delivery Service use other ranges to avoid overlaps of the Op Code values and to keep the Hamming distances across all CP Op Codes. The Op Codes of this characteristic are defined as follows:

Op Code Value	**Definition**	**Operand Section**	**Description**
0x0000 – 0x00FF	Prohibited	N/A	Reserved for IDD RACP and therefore prohibited
0x0100 – 0x0302	Prohibited	N/A	Prohibited to keep Hamming distance of CP Op Codes in Insulin Delivery Service
0x0303	Response Code	4.5.2.1	See Section 4.5.2.1
0x030C	Reset Status	4.5.2.2	Resets the status exposed by the IDD Status Changed characteristic. The response to this control point is *Response Code*.

Op Code Value	Definition	Operand Section	Description
0x0330	Get Active Bolus IDs	N/A	Gets the IDs of all Active Boluses (up to 7 Bolus IDs can be retrieved). The normal response to this control point is *Get Active Bolus ID Response*. For error conditions, the response is *Response Code*.
0x033F	Get Active Bolus IDs Response	4.5.2.4	This is the normal response to *Get Active Bolus IDs*.
0x0356	Get Active Bolus Delivery	4.5.2.5	Gets information about an Active Bolus identified by the given ID. The normal response to this control point is *Get Active Bolus Delivery Response*. For error conditions, the response is *Response Code*.
0x0359	Get Active Bolus Delivery Response	4.5.2.6	This is the normal response to *Get Active Bolus Delivery.*
0x0365	Get Active Basal Rate Delivery	N/A	Gets the current active basal rate setting, including the TBR. The normal response to this control point is *Get Active Basal Rate Delivery Response*. For error conditions, the response is *Response Code*.
0x036A	Get Active Basal Rate Delivery Response	4.5.2.8	This is the normal response to *Get Active Basal Rate Delivery*.
0x0395	Get Total Daily Insulin Status	N/A	Gets the total daily delivered bolus and basal insulin from midnight until now. When the day is done and as soon as midnight is reached, the total daily delivered amounts are reset. The normal response to this control point is *Get Total Daily Insulin Status Response*. For error conditions, the response is *Response Code*.
0x039A	Get Total Daily Insulin Status Response	4.5.2.10	This is the normal response to *Get Total Daily Insulin Status*.
0x03A6	Get Counter	4.5.2.11	Gets the value about an internal counter of the Insulin Delivery Device (e.g., the remaining warranty). The normal response to this control point is *Get Counter Response*. For error conditions, the response is *Response Code*.
0x03A9	Get Counter Response	4.5.2.12	This is the normal response to procedure *Get Counter*.

Op Code Value	Definition	Operand Section	Description
0x03C0	Get Delivered Insulin	4.5.2.13	Gets the delivered amount of bolus and basal insulin since the last rollover of these amounts. The Server rollover behavior shall be defined per Service. The normal response to this control point is *Get Delivered Insulin Response*. For error conditions, the response is *Response Code*.
0x03CF	Get Delivered Insulin Response	4.5.2.14	This is the normal response to procedure *Get Delivered Insulin*.
0x03F3	Get Insulin On Board	N/A	Gets the insulin on board, which has been delivered by the Insulin Delivery Device. The normal response to this control point is *Get Insulin On Board Response*. For error conditions, the response is *Response Code*.
0x03FC	Get Insulin On Board Response	4.5.2.15	This is the normal response to procedure *Get Insulin On Board*.
0x03FD – 0x0504	Prohibited	N/A	Prohibited to keep Hamming distance of CP Op Codes in Insulin Delivery Service
0x0505 – 0x0F3C	RFU	N/A	Hamming code values reserved for IDD Status Reader CP
0x0F3D – 0x0F54	Prohibited	N/A	Prohibited to keep Hamming distance of CP Op Codes in Insulin Delivery Service
0x0F55 – 0x1B7D	Prohibited	N/A	Reserved for IDD Command CP and therefore prohibited
All not already defined Hamming code values within 0x0000 and 0xFFFF	RFU	N/A	All values in this table which are not defined above and do match a Hamming code value in the range of 0x0000 and 0xFFFF are reserved for future use.
All other values	Prohibited	N/A	All values not defined above are prohibited.

Table 4.14: IDD Status Reader CP Op Codes

4.5.2   Operands

4.5.2.1   Response Code

The Operand of the *Response Code* Op Code is composed of a Request Op Code field (the Op Code of the requested procedure) and a Response Code Value field.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Request Op Code (see Op Code Values in Table 4.14)	M	uint16	2	None	LSO…MSO
Response Code Value	M	uint8	1	None	N/A
MSO ↑					

Table 4.15: IDD Status Reader CP Response Code Operand

The Response Code Values associated with the IDD Status Reader CP are the following:

Response Code Value	Definition	Description
0x0F	Success	Normal response for successful procedure.
0x70	Op Code not supported	Normal response if unsupported Op Code is received.
0x71	Invalid Operand	Normal response if Operand received does not meet the requirements of the service.
0x72	Procedure not completed	Normal response if unable to complete a procedure for any reason.
0x73	Parameter out of range	Normal response if Operand received does not meet the range requirements of the service.
0x74	Procedure not applicable	Normal response if the procedure cannot be executed because it is not applicable in the current Server Application context.
All not already defined values with a Hamming distance of 4 bits to 0x0F	RFU	All not already defined values with a Hamming distance of 4 bits to Response Code Value of *Success* = 0x0F are reserved for future use.
All other values	Prohibited	Values not having a Hamming distance of 4 bits to Response Code Value of *Success* =0xF0 shall not be defined and are prohibited.

Table 4.16: IDD Status Reader CP Response Code values

4.5.2.2 Reset Status

The Operand of the *Reset Status* Op Code is composed of a Flags field of the IDD Status Changed characteristic. A specific status can be reset by setting the corresponding bit to 1 (= True). If a bit is set to 0 (= False), the corresponding status will be retained.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	As defined in Section 4.1.1	As defined in Section 4.1.1	None	LSO…MSO
MSO ↑					

Table 4.17: IDD Status Reader CP Reset Status Operand

4.5.2.3 Get Active Bolus IDs

The *Get Active Bolus IDs* Op Code has no Operand.

4.5.2.4 Get Active Bolus IDs Response

The Operand of the *Get Active Bolus IDs Response* Op Code is composed of a Number of Active Boluses field and Bolus ID fields of up to seven currently Active Boluses. The Bolus ID fields represent unique identifiers of the currently Active Boluses that have been created by the Server application at the programming of those boluses.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Number of Active Boluses	M	uint8	1	None	N/A
Bolus ID1	C.1	uint16	2	None	LSO…MSO
Bolus ID2	C.2	uint16	2	None	LSO…MSO
Bolus ID3	C.3	uint16	2	None	LSO…MSO
Bolus ID4	C.4	uint16	2	None	LSO…MSO
Bolus ID5	C.5	uint16	2	None	LSO…MSO
Bolus ID6	C.6	uint16	2	None	LSO…MSO
Bolus ID7	C.7	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.18: IDD Status Reader CP Get Active Bolus IDs Response Operand

C.1:   Attached if at least 1 bolus is active, otherwise excluded.
C.2:   Attached if at least 2 boluses are active, otherwise excluded.
C.3:   Attached if at least 3 boluses are active, otherwise excluded.
C.4:   Attached if at least 4 boluses are active, otherwise excluded.
C.5:   Attached if at least 5 boluses are active, otherwise excluded.

C.6:   Attached if at least 6 boluses are active, otherwise excluded.

C.7:   Attached if at least 7 boluses are active, otherwise excluded.

4.5.2.5   Get Active Bolus Delivery

The Operand of the *Get Active Bolus Delivery* Op Code is composed of a Bolus ID field and a Bolus Value Selection field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus ID	M	uint16	2	None	LSO…MSO
Bolus Value Selection	M	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.19: IDD Status Reader CP Get Active Bolus Delivery Operand

4.5.2.5.1   Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server Application for a programmed bolus.

4.5.2.5.2   Bolus Value Selection values

The following values are defined for the Bolus Value Selection field:

Description	Value
Programmed	0x0F
Remaining	0x33
Delivered	0x3C
RFU	All not already defined Hamming code values within 0x00 and 0xFF
Prohibited	All other values

Table 4.20: Bolus Value Selection Values

4.5.2.6 Get Active Bolus Delivery Response

The Operand of the *Get Active Bolus Delivery Response* Op Code has the following structure:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Bolus ID	M	uint16	2	None	LSO…MSO
Bolus Type	M	Enumeration of uint8	1	None	N/A
Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
Bolus Delay Time	C.1	uint16	2	minutes	LSO…MSO
Bolus Template Number	C.2	uint8	1	None	N/A
Bolus Activation Type	C.3	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.21: IDD Status Reader CP Get Active Bolus IDs Response Operand

C.1:   Mandatory if *Bolus Delay Time Present* bit of Flags field is set to 1, otherwise excluded.
C.2:   Mandatory if *Bolus Template Number Present* bit of Flags field is set to 1, otherwise excluded.
C.3:   Mandatory if *Bolus Activation Type Present* bit of Flags field is set to 1, otherwise excluded.

[1] The Bolus Fast Amount field shall be set to 0 if Bolus Type is set to "Extended".
[2] The Bolus Extended Amount field shall be set to 0 if Bolus Type is set to "Fast".
[3] The Bolus Duration field shall be set to 0 if Bolus Type is set to "Fast".

4.5.2.6.1 Flags field

See Section 4.6.2.18.1.

4.5.2.6.2 Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server application for a programmed bolus.

4.5.2.6.3 Bolus Type values

The following values are defined for the Bolus Type field:

Description	Value
Undetermined	0x0F
Fast	0x33
Extended	0x3C
Multiwave	0x55
RFU	All not already defined Hamming code values within 0x00 and 0xFF
Prohibited	All other values

Table 4.22: Bolus Type values

4.5.2.6.4 Bolus Fast Amount field

The Bolus Fast Amount field represents the fast amount of the bolus.

- If the Bolus Value Selection Operand is set to "Programmed", this field contains the programmed fast amount of bolus.

- If the Bolus Value Selection Operand is set to "Remaining", this field contains the currently remaining fast amount.

- If the Bolus Value Selection Operand is set to "Delivered", this field contains the already delivered fast amount of the bolus.

- The Bolus Fast Amount field shall have a value of 0 if Bolus Type is "Extended".

4.5.2.6.5 Bolus Extended Amount field

The Bolus Extended Amount field represents the extended amount of the bolus.

- If the Bolus Value Selection Operand is set to "Programmed", this field contains the programmed extended amount of the bolus.

- If the Bolus Value Selection Operand is set to "Remaining", this field contains the currently remaining extended amount.

- If the Bolus Value Selection Operand is set to "Delivered", this field contains the already delivered extended amount of the bolus.

- The Bolus Extended Amount field shall have a value of 0 if Bolus Type is "Fast".

4.5.2.6.6 Bolus Duration field

- If the Bolus Value Selection Operand is set to "Programmed", this field contains the programmed duration of the bolus.

- If the Bolus Value Selection Operand is set to "Remaining", this field contains the currently remaining duration.

- If the Bolus Value Selection Operand is set to "Delivered", this field contains the elapsed time since the programming of the bolus.

- The Bolus Duration field shall have a value of 0 if Bolus Type is set to "Fast".

4.5.2.6.7   Bolus Delay Time

- If the Bolus Value Selection Operand is set to "Programmed", this field contains the programmed delay time of the bolus.

- If the Bolus Value Selection Operand is set to "Remaining", this field contains the currently remaining delay time until the delivery of the bolus.

- If the Bolus Value Selection Operand is set to "Delivered", this field is not applicable and the value shall be set to *0xFFFF*.

4.5.2.6.8   Bolus Activation Type values

See Section 4.6.2.18.3.

4.5.2.7   Get Active Basal Rate Delivery

The *Get Active Basal Rate Delivery* Op Code has no Operand.

4.5.2.8   Get Active Basal Rate Delivery Response

The Operand of the *Get Active Basal Rate Delivery Response* Op Code has the following structure:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Active Basal Rate Profile Template Number	M	uint8	1	None	N/A
Active Basal Rate Current Config Value[1]	M	SFLOAT	2	IU/h	LSO…MSO
TBR Type	C.1	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[2]	C.1	SFLOAT	2	IU/h or None[2]	LSO…MSO
TBR Duration Programmed	C.1	uint16	2	minutes	LSO…MSO
TBR Duration Remaining	C.1	uint16	2	minutes	LSO…MSO
TBR Template Number	C.2	uint8	1	None	N/A
Basal Delivery Context	C.3	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.23: IDD Status Reader CP Get Active Basal Rate Delivery Response Operand

C.1: Mandatory if *TBR Present* bit of Flags field is set to 1, otherwise excluded.

C.2: Mandatory if *TBR Present* bit and *TBR Template Number Present* bit of Flags field are set to 1, otherwise excluded.

C.3: Mandatory if *Basal Delivery Context Present* bit of Flags field is set to 1, otherwise excluded.

[1] The Active Basal Rate Current Config Value field represents the configured basal rate value of the current active basal rate profile within the current active time block. The current active time block is determined by the Server application by the current time of the Insulin Delivery Device. The Active Basal Rate Current Config Value always contains the originally programmed basal rate value regardless of an active TBR.

[2] The TBR Adjustment Value field refers to the Active Basal Rate Current Config Value field.
If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor (in this case, the adjusted basal rate value can be calculated by the Collector Application).

Note: Only one TBR regardless of its type (Relative or Absolute) can be active at the same time. If a TBR is currently active and another TBR is set, it will overwrite the previous setting.

4.5.2.8.1 Flags field

Bit	Definition	Description
0	TBR Present	If this bit is set, there is an active TBR. In this case, the fields TBR Type, TBR Adjustment Value, TBR Duration Programmed, and TBR Duration Remaining are present.
1	TBR Template Number Present	If this bit and the TBR Present bit are set, the TBR Template Number field is present.
2	Basal Delivery Context Present	If this bit is set, the Basal Delivery Context field is present.
All other bits	RFU	None

Table 4.24: Get Active Basal Rate Delivery Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.5.2.8.2 TBR Type values

The following values are defined for the TBR Type field:

Description	Value
Undetermined	0x0F
Absolute	0x33

Description	Value
Relative	0x3C
RFU	All not already defined Hamming code values within 0x00 and 0xFF
Prohibited	All other values

Table 4.25: TBR Type values

4.5.2.8.3 Basal Delivery Context values

The following values are defined for the Basal Delivery Context field:

Description	Value	Meaning
Undetermined	0x0F	The basal delivery context is undetermined.
Device Based	0x33	The current basal rate was set directly on the Insulin Delivery Device (e.g., an active basal rate reached a new time block, the user changed the active basal rate profile or triggered a TBR directly on the device).
Remote Control	0x3C	The current basal rate was set via a remote control (i.e., an external device). For example, the user changed the active basal rate profile or triggered a TBR via a remote control.
Artificial Pancreas (AP) Controller	0x55	The current basal rate was set by an AP Controller (i.e., an external automated device) as part of an Artificial Pancreas Device System (APDS).
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.26: Basal Delivery Context values

4.5.2.9 Get Total Daily Insulin Status

The *Get Total Daily Insulin Status* Op Code has no Operand.

4.5.2.10 Get Total Daily Insulin Status Response

The Operand of the *Get Total Daily Insulin Status Response* Op Code has the following structure:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Total Daily Insulin Sum of Bolus Delivered[1]	M	SFLOAT	2	IU	LSO…MSO
Total Daily Insulin Sum of Basal Delivered[2]	M	SFLOAT	2	IU	LSO…MSO

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Total Daily Insulin Sum of Bolus and Basal Delivered[3]	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.27: IDD Status Reader CP Get Total Daily Insulin Status Response Operand

[1] This field shall be set to 0 if the Insulin Delivery Device does not support boluses (i.e., Bits 5, 6, 7 are not set in Flags field of IDD Features)

[2] This field shall be set to 0 if the Insulin Delivery Device does not support a basal rate (i.e., Bit 1 is not set in Flags field of IDD Features)

[3] This field may not be the exact sum of Total Daily Insulin Sum of Bolus Delivered field and Total Daily Insulin Sum of Basal Delivered field due to SFLOAT limited precision and related rounding

4.5.2.11   Get Counter

The Operand of the *Get Counter* Op Code is composed of a Counter Type field and a Counter Value Selection field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Counter Type	M	Enumeration of uint8	1	None	N/A
Counter Value Selection	M	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.28: IDD Status Reader CP Get Counter Operand

4.5.2.11.1   Counter Type values

The following values are defined for the Counter Type field:

Description	Value	Meaning
IDD Lifetime	0x0F	This counter provides the lifetime of the Insulin Delivery Device. It can be used if the device shall have a limited lifetime for operation.
IDD Warranty Time	0x33	This counter provides the warranty time of the Insulin Delivery Device. It can be used if the device shall have a limited warranty time.
IDD Loaner Time	0x3C	This counter provides the loaner time of the Insulin Delivery Device. It can be used if the device is loaned for a limited time.

Description	Value	Meaning
Reservoir Insulin Operation Time	0x55	This counter provides the operation time of the insulin in the reservoir. It can be used to warn the user when the insulin in the reservoir gets too old.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.29: Counter Type values

4.5.2.11.2   Counter Value Selection values

The following values are defined for the Counter Value Selection field:

Description	Value
Remaining	0x0F
Elapsed	0x33
RFU	All not already defined Hamming code values within 0x00 and 0xFF
Prohibited	All other values

Table 4.30: Counter Type values

4.5.2.12   Get Counter Response

The Operand of the *Get Counter Response* Op Code is composed of the Counter Type, Counter Value Selection and a Counter Value:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Counter Type	M	Enumeration of uint8	1	None	N/A
Counter Value Selection	M	Enumeration of uint8	1	None	N/A
Counter Value	M	int32	4	minutes	LSO…MSO
MSO ↑					

Table 4.31: IDD Status Reader CP Get Counter Response Operand

4.5.2.12.1   Counter Type values

See Section 4.5.2.11.1.

4.5.2.12.2   Counter Value Selection values

See Section .

4.5.2.12.3   Counter Value field

The Counter Value field represents the current value for the requested *Counter Type* and *Counter Value Selection* fields in the *Get Counter* request.

If the Counter Value Selection field in the *Get Counter* request is set to *Remaining*, this field contains the remaining time before the requested *Counter Type* expires. The remaining time value of a counter decrements from a predefined value (e.g., manufacturer defined). This value may be negative and in this case, its absolute value is the time since expiration of the counter.

If the Counter Value Selection field in the *Get Counter* request is set to *Elapsed*, this field contains the elapsed time since the counter of the requested *Counter Type* started. The elapsed time value of a counter increments from 0 and thus cannot be a negative value.

4.5.2.13   Get Delivered Insulin

The *Get Delivered Insulin* Op Code has no Operand.

4.5.2.14   Get Delivered Insulin Response

The Operand of the *Get Delivered Insulin Response* Op Code has the following structure:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus Amount Delivered	M	FLOAT	4	IU	LSO…MSO
Basal Amount Delivered	M	FLOAT	4	IU	LSO…MSO
MSO ↑					

Table 4.32: IDD Status Reader CP Get Delivered Insulin Response Operand

4.5.2.14.1   Bolus Amount Delivered field

The Bolus Amount Delivered field exposes the delivered bolus insulin since the last rollover of this amount. The Server rollover behavior shall be defined per Service.

4.5.2.14.2   Basal Amount Delivered field

The Basal Amount Delivered field exposes the delivered basal insulin since the last rollover of this amount. The Server rollover behavior shall be defined per Service.

4.5.2.15   Get Insulin On Board

The *Get Insulin On Board* Op Code has no Operand.

4.5.2.16　Get Insulin On Board Response

The Operand of the *Get Insulin On Board Response* Op Code has the following structure:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Insulin On Board	M	SFLOAT	2	IU	LSO…MSO
Remaining Duration	C.1	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.33: IDD Status Reader CP Get Insulin On Board Response Operand

C.1:　　Mandatory if *Remaining Duration Present* bit of Flags field is set to 1, otherwise excluded.

4.5.2.16.1　Flags field

Bit	Definition	Description
0	Remaining Duration Present	If this bit is set, the Remaining Duration field is present.
All other bits	RFU	None

Table 4.34: Get Insulin On Board Response Operand Flags field

　　Note:　The bits in the table above are defined as: 0 = False and 1 = True

4.5.2.16.2　Insulin On Board field

The Insulin On Board field represents the amount of bolus insulin that was previously delivered but is still active in the body.

4.5.2.16.3　Remaining Duration field

The Remaining Duration field represents the remaining time until the Insulin On Board is not active in the body anymore.

4.6　IDD Command Control Point

The IDD Command Control Point is identified using the UUID «IDD Command Control Point», as defined in [2].

This control point is used with a service to provide the ability to support the insulin therapy by adapting therapy parameters to enable the remote operation of the insulin therapy as well as the remote operation for device maintenance.

The structure of the IDD Command Control Point is defined below:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Op Code (see Op Code Values in Table 4.36)	M	Enumeration of uint16	2	None	LSO…MSO
Operand (value defined per Service)	M	Variable	0 to 15	None	LSO…MSO
E2E-Counter	C.1	uint8	1	N/A	N/A
E2E-CRC	C.1	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.35: IDD Command Control Point

C.1:   Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

4.6.1   Op Codes

The Op Code values from *0x0F55 - 0x1B7D* are reserved for the IDD Command CP to allow 100 Op Codes with Hamming distance of 4. Other Control Points in the context of the Insulin Delivery Service use other ranges to avoid overlaps of the Op Code values and to keep the Hamming distances across all CP Op Codes. The Op Codes of this characteristic are defined as follows:

Op Code Value	Definition	Operand Section	Description
0x0000 – 0x00FF	Prohibited	N/A	Reserved for IDD RACP and therefore prohibited
0x0100 – 0x0302	Prohibited	N/A	Prohibited to keep Hamming distance of CP Op Codes in Insulin Delivery Service

Op Code Value	Definition	Operand Section	Description
0x0303 – 0x0F3C	Prohibited	N/A	Reserved for IDD Status Reader CP and therefore prohibited
0x0F3D – 0x0F54	Prohibited	N/A	Prohibited to keep Hamming distance of CP Op Codes in Insulin Delivery Service
0x0F55	Response Code	4.6.2.1	See Section 4.6.2.1
0x0F5A	Set Therapy Control State	4.6.2.2	Set the therapy control state of the Insulin Delivery Device. The response to this control point is *Response Code*.
0x0F66	Set Flight Mode	N/A	Activates the flight mode of the Insulin Delivery Device. The response to this control point is *Response Code*.
0x0F69	Snooze Annunciation	4.6.2.4	Snoozes an annunciation for a limited amount of time. The normal response to this control point is *Snooze Annunciation Response*. For error conditions, the response is *Response Code*.
0x0F96	Snooze AnnunciationResponse	4.6.2.5	This is the normal response to *Snooze Annunciation*.
0x0F99	Confirm Annunciation	4.6.2.6	Confirms an annunciation on the Server Application and removes this specific annunciation from the list of currently active annunciations on the Server Application. The normal response to this control point is *Confirm Annunciation Response*. For error conditions, the response is *Response Code*.
0x0FA5	Confirm AnnunciationResponse	4.6.2.7	This is the normal response to *Confirm Annunciation*.
0x0FAA	Read Basal Rate Profile Template	4.6.2.8	Reads a specific Basal Rate Profile Template. The response to this control point is *Response Code*.
0x0FC3	Read Basal Rate Profile Template Response	4.6.2.9	This response is used to report one or more time blocks of a Basal Rate Profile Template.
0x0FCC	Write Basal Rate Profile Template	4.6.2.10	Writes a specific Basal Rate Profile Template. The normal response to this control point is *Write Basal Rate Profile Template Response*. For error conditions, the response is *Response Code*.
0x0FF0	Write Basal Rate Profile Template Response	4.6.2.11	This is the normal response to *Write Basal Rate Profile Template*.

Op Code Value	Definition	Operand Section	Description
0x0FFF	Set TBR Adjustment	4.6.2.12	Sets a new or changes a currently active TBR. The response to this control point is *Response Code*.
0x1111	Cancel TBR Adjustment	N/A	Cancels a currently active TBR. The response to this control point is *Response Code*.
0x111E	Get TBR Template	4.6.2.14	Gets the parameters of a specific TBR template. The normal response to this control point is *Get TBR Template Response*. For error conditions, the response is *Response Code*.
0x1122	Get TBR Template Response	4.6.2.15	This is the normal response to *Get TBR Template.*
0x112D	Set TBR Template	4.6.2.16	Sets the parameters of a specific TBR template. The normal response to this control point is *Set TBR Template Response*. For error conditions, the response is *Response Code*.
0x1144	Set TBR Template Response	4.6.2.17	This is the normal response to *Set TBR Template.*
0x114B	Set Bolus	4.6.2.18	Sets a bolus with the specified parameters. The normal response to this control point is *Set Bolus Response*. For error conditions, the response is *Response Code*.
0x1177	Set Bolus Response	4.6.2.19	This is the normal response to *Set Bolus.*
0x1178	Cancel Bolus	4.6.2.20	Cancels a bolus with the specified Bolus ID. The normal response to this control point is *Cancel Bolus Response*. For error conditions, the response is *Response Code*.
0x1187	Cancel Bolus Response	4.6.2.21	This is the normal response to *Cancel Bolus.*
0x1188	Get Available Boluses	N/A	Gets the currently available bolus types. The normal response to this control point is *Get Available Boluses Response*. For error conditions, the response is *Response Code*.
0x11B4	Get Available Boluses Response	4.6.2.23	This is the normal response to *Get Available Boluses.*
0x11BB	Get Bolus Template	4.6.2.24	Gets the parameters of a specific bolus template. The normal response to this control point is *Get Bolus Template Response*. For error conditions, the response is *Response Code*.

Op Code Value	Definition	Operand Section	Description
0x11D2	Get Bolus Template Response	4.6.2.25	This is the normal response to *Get Bolus Template.*
0x11DD	Set Bolus Template	4.6.2.26	Sets the parameters of a specific bolus template. The normal response to this control point is *Set Bolus Template Response*. For error conditions, the response is *Response Code*.
0x11E1	Set Bolus Template Response	4.6.2.27	This is the normal response to *Set Bolus Template.*
0x11EE	Get Template Status and Details	4.6.2.28	Gets the status and details of all the supported template types (i.e., if they are configured and / or configurable, the max number of supported time blocks and the template number range). The normal response to this control point is *Get Template Status and Details Response*. For error conditions, the response is *Response Code*.
0x1212	Get Template Status and Details Response	4.6.2.29	This is the normal response to *Get Template Status and Details.*
0x121D	Reset Template Status	4.6.2.30	Resets the status of one or many templates by marking them as *Not Configured*. The normal response to this control point is *Reset Template Status Response*. For error conditions, the response is *Response Code*.
0x1221	Reset Template Status Response	4.6.2.31	This is the normal response to *Reset Template Status.*
0x122E	Activate Profile Templates	4.6.2.32	Activates profile templates. The normal response to this control point is *Activate Profile Templates Response*. For error conditions, the response is *Response Code*.
0x1247	Activate Profile Templates Response	4.6.2.33	This is the normal response to Activate Profile Templates.
0x1248	Get Activated Profile Templates	4.6.2.34	Gets all the currently activated profile templates (e.g., basal rate profile template). The normal response to this control point is *Get Activated Profile Templates Response*. For error conditions, the response is *Response Code*.
0x1274	Get Activated Profile Templates Response	4.6.2.35	This is the normal response to *Get Activated Profile Templates.*

Op Code Value	Definition	Operand Section	Description
0x127B	Start Priming	4.6.2.36	Starts the priming of the fluidic path of the Insulin Delivery Device with the provided amount of insulin. The priming is stopped as soon as that amount is delivered. The response to this control point is *Response Code*.
0x1284	Stop Priming	N/A	Stops the priming of the fluidic path of the Insulin Delivery Device immediately. The response to this control point is *Response Code*.
0x128B	Set Initial Reservoir Fill Level	4.6.2.38	Sets the initial fill level of the reservoir after refill or replacement. The response to this control point is *Response Code*.
0x12B7	Reset Reservoir Insulin Operation Time	N/A	Resets the counter *Reservoir Insulin Operation Time* (retrieved by procedure *Get Counter* of IDD Status Reader CP with Counter Type *Reservoir Insulin Operation Time*). The response to this control point is *Response Code*.
0x12B8	Read ISF Profile Template	4.6.2.40	Reads a specific ISF Profile Template. The response to this control point is *Response Code*.
0x12D1	Read ISF Profile Template Response	4.6.2.41	This response is used to report one or more time blocks of an ISF Profile Template.
0x12DE	Write ISF Profile Template	4.6.2.42	Writes a specific ISF Profile Template. The normal response to this control point is *Write ISF Profile Template Response*. For error conditions, the response is *Response Code*.
0x12E2	Write ISF Profile Template Response	4.6.2.43	This is the normal response to *Write ISF Profile Template.*
0x12ED	Read I2CHO Ratio Profile Template	4.6.2.44	Reads a specific I:CHO Ratio Profile Template. The response to this control point is *Response Code*.
0x1414	Read I2CHO Ratio Profile Template Response	4.6.2.45	This response is used to report one or more time blocks of an I:CHO Ratio Profile Template.
0x141B	Write I2CHO Ratio Profile Template	4.6.2.46	Writes a specific I:CHO Ratio Profile Template. The normal response to this control point is *Write I2CHO Ratio Profile Template Response*. For error conditions, the response is *Response Code*.

Op Code Value	Definition	Operand Section	Description
0x1427	Write I2CHO Ratio Profile Template Response	4.6.2.47	This is the normal response to *Write I2CHO Ratio Profile Template.*
0x1428	Read Target Glucose Range Profile Template	4.6.2.48	Reads a specific Target Glucose Range Profile Template. The response to this control point is *Response Code.*
0x1441	Read Target Glucose Range Profile Template Response	4.6.2.49	This response is used to report one or more time blocks of a Target Glucose Range Profile Template.
0x144E	Write Target Glucose Range Profile Template	4.6.2.50	Writes a specific Target Glucose Range Profile Template. The normal response to this control point is *Write Target Glucose Range Profile Template Response.* For error conditions, the response is *Response Code.*
0x1472	Write Target Glucose Range Profile Template Response	4.6.2.51	This is the normal response to *Write Target Glucose Range Profile Template.*
0x147D	Get Max Bolus Amount	N/A	Gets the maximum bolus amount that can be delivered in a single bolus.
0x1482	Get Max Bolus Amount Response	4.6.2.53	This is the normal response to *Get Max Bolus Amount.*
0x148D	Set Max Bolus Amount	4.6.2.54	Sets the maximum bolus amount that can be delivered in a single bolus
0x148E – 0x14B0	Prohibited	N/A	Prohibited to keep Hamming distance of CP Op Codes in Insulin Delivery Service
0x14B1 – 0x1B7D	RFU	N/A	Hamming code values reserved for IDD Command CP
All not already defined Hamming code values within 0x0000 and 0xFFFF	RFU	N/A	All values in this table which are not defined above and do match a Hamming code value in the range of 0x0000 and 0xFFFF are reserved for future use.
All other values	Prohibited	N/A	All values not defined above are prohibited.

Table 4.36: IDD Command CP Op Codes

4.6.2   Operands

4.6.2.1   Response Code

The Operand of the *Response Code* Op Code is composed of a Request Op Code field (the Op Code of the requested procedure) and a Response Code Value field.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Request Op Code (see Op Code Values in Table 4.36)	M	uint16	2	None	LSO…MSO
Response Code Value	M	uint8	1	None	N/A
MSO ↑					

Table 4.37: IDD Command CP Response Code Operand

The Response Code Values associated with the IDD Command CP are the following:

Response Code Value	**Definition**	**Description**
0x0F	Success	Normal response for successful procedure.
0x70	Op Code not supported	Normal response if unsupported Op Code is received.
0x71	Invalid Operand	Normal response if Operand received does not meet the requirements of the service.
0x72	Procedure not completed	Normal response if unable to complete a procedure for any reason.
0x73	Parameter out of range	Normal response if Operand received does not meet the range requirements of the service.
0x74	Procedure not applicable	Normal response if the procedure cannot be executed because it is not applicable in the current Server Application context.
0x75	Plausibility check failed	Normal response if a transaction consisting of several procedures was not completed by the Server because the parameters provided by the Client to perform this transaction has been invalid or inconsistent.

Response Code Value	Definition	Description
0x76	Maximum Bolus Number reached	Normal response if the maximum number of boluses of a specific type is reached when executing the Set Bolus procedure. The maximum available number of boluses depends on the implementation of Insulin Delivery Device and which boluses are already running.
All not already defined values with a Hamming distance of 4 bits to 0x0F	RFU	All not already defined values with a Hamming distance of 4 bits to Response Code Value of *Success* = 0x0F are reserved for future use.
All other values	Prohibited	Values not having a Hamming distance of 4 bits to Response Code Value of *Success* = 0x0F shall not be defined and are prohibited.

Table 4.38: IDD Command CP Response Code values

4.6.2.2 Set Therapy Control State

The Operand of the *Set Therapy Control State* Op Code is composed of a Therapy Control State field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Therapy Control State	M	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.39: IDD Command CP Set Therapy Control State Operand

4.6.2.2.1 Therapy Control State values

See Section 4.2.1.1 for the Therapy Control State values.

4.6.2.3 Set Flight Mode

The *Set Flight Mode* Op Code has no Operand.

4.6.2.4 Snooze Annunciation

The Operand of the *Snooze Annunciation* Op Code is composed of an Annunciation Instance ID field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Annunciation Instance ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.40: IDD Command CP Snooze Annunciation Operand

4.6.2.5 Snooze Annunciation Response

The Operand of the *Snooze Annunciation Response* Op Code is composed of an Annunciation Instance ID field, which is the Annunciation Instance ID of the snoozed annunciation.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Annunciation Instance ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.41: IDD Command CP Snooze Annunciation Response Operand

4.6.2.6 Confirm Annunciation

The Operand of the *Confirm Annunciation* Op Code is composed of an Annunciation Instance ID field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Annunciation Instance ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.42: IDD Command CP Confirm Annunciation Operand

4.6.2.7 Confirm Annunciation Response

The Operand of *Confirm Annunciation Response* Op Code is composed of an Annunciation Instance ID field, which is the Annunciation Instance ID of the confirmed annunciation.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Annunciation Instance ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.43: IDD Command CP Confirm Annunciation Response Operand

4.6.2.8 Read Basal Rate Profile Template

The Operand of the *Read Basal Rate Profile Template* Op Code is composed of a Basal Rate Profile Template Number field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Basal Rate Profile Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.44: IDD Command CP Read Basal Rate Profile Template Operand

4.6.2.9 Read Basal Rate Profile Template Response

The *Read Basal Rate Profile Template Response* Op Code has no Operand in the context of the IDD Command Control Point, but there is an Operand in the context of the IDD Command Data characteristic, which is defined in the Insulin Delivery Service (see Section 3.8.1.4).

4.6.2.10 Write Basal Rate Profile Template

The Operand of the *Write Basal Rate Profile Template* Op Code could contain up to three time blocks which are described by their durations in minutes and their rates in IU/h. Depending on the overall number of time blocks and due to the default MTU size, several executions of the Write Basal Rate Profile Template procedure may be required to write the complete basal rate profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire basal rate profile (i.e., the index of the second time block shall be calculated by adding a value of 1 to that field and a value of 2 shall be added to get the index of the third time block). That field is set to a value in the range of 1 till the maximum number of supported time blocks of the basal rate profile template.

The Operand is composed of a Flags field that signals the end of the write transaction and the presence of the fields of the second and third time block within this record, and a First Time Block Number Index field that represents the index of the following time blocks within the entire basal rate profile. The Operand is closed by the fields with the durations and rates of the (up to) three time blocks.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Basal Rate Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First Rate	M	SFLOAT	2	IU/h	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second Rate	C.1	SFLOAT	2	IU/h	LSO…MSO
Third Duration	C.2	uint16	2	minutes	LSO…MSO
Third Rate	C.2	SFLOAT	2	IU/h	LSO…MSO
MSO ↑					

Table 4.45: IDD Command CP Write Basal Rate Profile Template Operand

C.1:   Attached if bit 1 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 2 of Flags field is set, otherwise excluded.

4.6.2.10.1   Flags field

Bit	Definition	Description
0	End Transaction	If this bit is set, it signals the Server that all time blocks of the basal rate profile have been sent (i.e., the basal rate profile is complete). It shall only be set if the last time blocks of the basal rate profile are sent.
1	Second Time Block Present	If this bit is set, the fields Second Duration and Second Rate are present.
2	Third Time Block Present	If this bit is set, the fields Third Duration and Third Rate are present.
All other bits	RFU	None

Table 4.46: Write Basal Rate Profile Template Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.11   Write Basal Rate Profile Template Response

The Operand of the *Write Basal Rate Profile Template Response* Op Code is composed of a Flags field that signals the completion of the write transaction, a Basal Rate Profile Template Number field that is the

basal rate profile template number of the written basal rate profile, and a First Time Block Number Index field that is the index of the first sent time block of this Operand within the entire basal rate profile.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Basal Rate Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
MSO ↑					

Table 4.47: IDD Command CP Write Basal Rate Profile Template Response Operand

4.6.2.11.1   Flags field

Bit	Definition	Description
0	Transaction Completed	If this bit is set, the basal rate profile passed the plausibility checks of the Server and was written successfully (i.e., the write transaction of all time blocks of the basal rate profile completed).
All other bits	RFU	None

Table 4.48: Write Basal Rate Profile Template Response Operand Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.12   Set TBR Adjustment

The Operand of the *Set TBR Adjustment Op Code* has the following structure:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
TBR Type	M	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[1]	M	SFLOAT	2	IU/h or None[1]	LSO…MSO
TBR Duration	M	uint16	2	minutes	LSO…MSO

LSO ↓					
TBR Template Number	C.1	uint8	1	None	N/A
TBR Delivery Context	C.2	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.49: IDD Command CP Set TBR Adjustment Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.

[1] If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.6.2.12.1   Flags field

Bit	Definition	Description
0	TBR Template Number Present	If this bit is set, the TBR Template Number field is present.
1	TBR Delivery Context Present	If this bit is set, the TBR Delivery Context field is present.
2	Change TBR	If this bit is set, a currently active TBR shall be completely overwritten with the changed settings; otherwise a new TBR shall be activated (i.e., the changed settings are new settings and are not based on the settings of the currently active TBR).
All other bits	RFU	None

Table 4.50: Set TBR Adjustment Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.12.2   TBR Type values

See Section 4.5.2.8.2.

4.6.2.12.3   TBR Adjustment Value field

If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.6.2.12.4 TBR Delivery Context values

The following values are defined for the Basal Delivery Context field:

Description	Value	Meaning
Undetermined	0x0F	The delivery context is undetermined.
Device Based	0x33	The TBR was initiated directly on the Insulin Delivery Device (e.g., the user triggers a TBR directly on the device).
Remote Control	0x3C	The TBR was initiated via a remote control (i.e., an external device). For example, the user triggers a TBR via a remote control.
AP Controller	0x55	The TBR was initiated by an AP Controller (i.e., an external automated device) as part of an APDS.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.51: TBR Delivery Context Values

4.6.2.13 Cancel TBR Adjustment

The *Cancel TBR Adjustment* Op Code has no Operand.

4.6.2.14 Get TBR Template

The Operand of the *Get TBR Template* Op Code is composed of a TBR Template Number field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
TBR Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.52: IDD Command CP Get TBR Template Operand

4.6.2.15 Get TBR Template Response

The Operand of the *Get TBR Template Response* Op Code has the following structure:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
TBR Template Number	M	uint8	1	None	N/A
TBR Type	M	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[1]	M	SFLOAT	2	IU/h or None[1]	LSO…MSO
TBR Duration	M	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.53: IDD Command CP Get TBR Template Response Operand

[1] If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.6.2.15.1 TBR Type values

See Section 4.5.2.8.2

4.6.2.16 Set TBR Template

The Operand of the *Set TBR Template* Op Code has the following structure:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
TBR Template Number	M	uint8	1	None	N/A
TBR Type	M	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[1]	M	SFLOAT	2	IU/h or None[1]	LSO…MSO
TBR Duration	M	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.54: IDD Command CP Set TBR Template Operand

[1] If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.6.2.16.1 TBR Type values

See Section 4.5.2.8.2

4.6.2.17 Set TBR Template Response

The Operand of the *Set TBR Template Response* Op Code is composed of a TBR Template Number field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
TBR Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.55: IDD Command CP Set TBR Template Response Operand

4.6.2.18 Set Bolus

The Operand of the *Set Bolus* Op Code has the following structure:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Bolus Type	M	Enumeration of uint8	1	None	N/A
Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
Bolus Delay Time	C.1	uint16	2	minutes	LSO…MSO
Bolus Template Number	C.2	uint8	1	None	N/A
Bolus Activation Type	C.3	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.56: IDD Command CP Set Bolus Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.
C.3:   Attached if bit 2 of Flags field is set, otherwise excluded.

[1] The Bolus Fast Amount field shall be set to 0 if Bolus Type is set to "Extended".
[2] The Bolus Extended Amount field shall be set to 0 if Bolus Type is set to "Fast".
[3] The Bolus Duration field shall be set to 0 if Bolus Type is set to "Fast".

4.6.2.18.1   Flags field

Bit	Definition	Description
0	Bolus Delay Time Present	If this bit is set, the Bolus Delay Time field is present.
1	Bolus Template Number Present	If this bit is set, the Bolus Template Number field is present.
2	Bolus Activation Type Present	If this bit is set, the Bolus Activation Type field is present.
3	Bolus Delivery Reason Correction	If this bit is set, the reason for the bolus is the correction of a high blood glucose level.
4	Bolus Delivery Reason Meal	If this bit is set, the reason for the bolus is to cover the intake of food.
All other bits	RFU	None

Table 4.57: Set Bolus Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.18.2   Bolus Type values

See Section 4.5.2.6.3.

4.6.2.18.3   Bolus Activation Type values

The Bolus Activation Type provides additional information about the source and when possible, the determination of the bolus amount.

The following values are defined for the Bolus Activation Type field:

Description	Value	Meaning
Undetermined	0x0F	The activation type is undetermined.
Manual Bolus	0x33	The bolus was defined by the user.
Recommended Bolus	0x3C	The bolus was recommended by a calculation algorithm (e.g., a bolus calculator) and confirmed by the user.
Manually Changed Recommended Bolus	0x55	The user changed a recommended bolus.
Commanded Bolus	0x5A	The bolus was activated without user interaction (e.g., by an APDS)
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.58: Bolus Activation Type values

4.6.2.19 Set Bolus Response

The Operand of the *Set Bolus Response* Op Code is composed of a Bolus ID field of the programmed bolus that represents a unique identifier as a uint16 data type created by the Server application:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.59: IDD Command CP Set Bolus Response Operand

4.6.2.19.1 Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server Application for a programmed bolus.

4.6.2.20 Cancel Bolus

The Operand of the *Cancel Bolus* Op Code is composed of a Bolus ID field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.60: IDD Command CP Cancel Bolus Operand

4.6.2.20.1 Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server Application for a programmed bolus.

4.6.2.21 Cancel Bolus Response

The Operand of the *Cancel Bolus Response* Op Code is composed of a Bolus ID field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus ID	M	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.61: IDD Command CP Cancel Bolus Response Operand

4.6.2.21.1 Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server Application for a programmed bolus.

4.6.2.22 Get Available Boluses

The *Get Available Boluses* Op Code has no Operand.

4.6.2.23 Get Available Boluses Response

The Operand of the *Get Available Boluses Response* Op Code is composed of a Flags field that indicates the currently available bolus types that can be set:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
MSO ↑					

Table 4.62: IDD Command CP Get Available Boluses Response Operand

4.6.2.23.1 Flags field

Bit	Definition	Description
0	Fast Bolus Available	If this bit is set, a fast bolus is currently available to be set.
1	Extended Bolus Available	If this bit is set, an extended bolus is currently available to be set.
2	Multiwave Bolus Available	If this bit is set, a multiwave bolus is currently available to be set.
All other bits	RFU	None

Table 4.63: Get Available Boluses Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.24   Get Bolus Template

The Operand of the *Get Bolus Template* Op Code is composed of a Bolus Template Number field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.64: IDD Command CP Get Bolus Template Operand

4.6.2.25   Get Bolus Template Response

The Operand of the *Get Bolus Template Response* Op Code has the following structure:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus Template Number	M	uint8	1	None	N/A
Flags	M	8 bit	1	None	N/A
Bolus Type	M	Enumeration of uint8	1	None	N/A
Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
Bolus Delay Time	C.1	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.65: IDD Command CP Get Bolus Template Response Operand

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.

[1] The Bolus Fast Amount field is set to 0 if Bolus Type is set to "Extended".
[2] The Bolus Extended Amount field is set to 0 if Bolus Type is set to "Fast".
[3] The Bolus Duration field is set to 0 if Bolus Type is set to "Fast".

4.6.2.25.1 Flags field

Bit	Definition	Description
0	Bolus Delay Time Present	If this bit is set, the Bolus Delay Time field is present.
1	Bolus Delivery Reason Correction	If this bit is set, the reason for the bolus is the correction of a high blood glucose level.
2	Bolus Delivery Reason Meal	If this bit is set, the reason for the bolus is to cover the intake of food.
All other bits	RFU	None

Table 4.66: Get Bolus Template Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.25.2 Bolus Type values

See Section 4.5.2.6.3.

4.6.2.26 Set Bolus Template

The Operand of the *Set Bolus Template* Op Code has the following structure:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Bolus Template Number	M	uint8	1	None	N/A
Flags	M	8 bit	1	None	N/A
Bolus Type	M	Enumeration of uint8	1	None	N/A
Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
Bolus Delay Time	C.1	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.67: IDD Command CP Set Bolus Template Operand

C.1: Attached if bit 0 of Flags field is set, otherwise excluded.

[1] The Bolus Fast Amount field shall be set to 0 if Bolus Type is set to "Extended".
[2] The Bolus Extended Amount field shall be set to 0 if Bolus Type is set to "Fast".
[3] The Bolus Duration field shall be set to 0 if Bolus Type is set to "Fast".

4.6.2.26.1   Flags field

See Section 4.6.2.25.1.

4.6.2.26.2   Bolus Type values

See Section 4.5.2.6.3.

4.6.2.27   Set Bolus Template Response

The Operand of the *Set Bolus Template Response* Op Code is composed of a Bolus Template Number field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Bolus Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.68: IDD Command CP Set Bolus Template Response Operand

4.6.2.28   Get Template Status and Details

The *Get Template Status and Details* Op Code has no Operand.

4.6.2.29   Get Template Status and Details Response

The *Get Template Status and Details Response* Op Code has no Operand in the context of the IDD Command Control Point, but there is an Operand in the context of the IDD Command Data characteristic, which is defined in the Insulin Delivery Service (see Section 3.8.1.8).

4.6.2.30   Reset Template Status

The Operand of the *Reset Template Status* Op Code is composed of a Number of Templates to Reset and an array of Template Numbers field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Number of Templates to Reset	M	uint8	1	None	N/A
Template Numbers	M	Array of uint8	1 to 14	None	LSO…MSO
MSO ↑					

Table 4.69: IDD Command CP Reset Template Status Operand

4.6.2.30.1   Number of Templates to Reset field

The Number of Templates to Reset field value is the total number of templates included in the request to be reset.

4.6.2.30.2 Template Numbers field

The Template Numbers field value is an array of template numbers to be reset. The total number of elements in this array is the value of the Number of Templates to Reset field in 4.6.2.30.1.

4.6.2.31 Reset Template Status Response

The Operand of the *Reset Template Status Response* Op Code is composed of a Number of Templates to Reset and an array of Template Numbers field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Number of Templates Reset	M	uint8	1	None	N/A
Template Numbers	M	Array of uint8	1 to 14	None	LSO…MSO
MSO ↑					

Table 4.70: IDD Command CP Reset Template Status Response Operand

4.6.2.31.1 Number of Templates Reset field

The Number of Templates Reset field value is the total number of templates that were reset.

4.6.2.31.2 Template Numbers field

The Template Numbers field value is an array of template numbers that were reset. The total number of elements in this array is the value of the Number of Templates Reset field in 4.6.2.31.1.

4.6.2.32 Activate Profile Templates

The Operand of the *Activate Profile Templates* Op Code is composed of a Number of Profile Templates to Activate and an array of Profile Template Numbers field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Number of Profile Templates to Activate	M	uint8	1	None	N/A
Profile Template Numbers	M	Array of uint8	1 to 14	None	LSO…MSO
MSO ↑					

Table 4.71: IDD Command CP Activate Profile Templates Operand

4.6.2.32.1 Number of Profile Templates to Activate field

The Number of Profile Templates to Activate field value is the total number of profile templates to be activated.

4.6.2.32.2 Profile Template Numbers field

The Profile Template Numbers field value is an array of profile template numbers to be activated. The total number of elements in this array is the value of the Number of Profile Templates field in Section 4.6.2.32.1.

4.6.2.33 Activate Profile Templates Response

The Operand of the *Activate Profile Templates Response* Op Code is composed of a Number of Profile Templates Activated field and an array of Profile Template Numbers field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Number of Profile Templates Activated	M	uint8	1	None	N/A
Profile Template Numbers	M	Array of uint8	1 to 14	None	LSO…MSO
MSO ↑					

Table 4.72: IDD Command CP Activate Profile Templates Response Operand

4.6.2.33.1 Number of Profile Templates Activated

The Number of Profile Templates Activated field value shall be the total number of profile templates that were activated by an Activate Profile Templates procedure in Section 4.6.2.32.

4.6.2.33.2 Profile Template Numbers

The Profile Template Numbers field is an array of the profile template numbers that were activated. The total number of elements in this array is the value of the Number of Profile Templates Activated field in Section 4.6.2.33.1.

4.6.2.34 Get Activated Profile Templates

The *Get Activated Profile Templates* Op Code has no Operand.

4.6.2.35 Get Activated Profile Templates Response

The Operand of the Get Activated Profile Templates Response Op Code is composed of a Number of Activated Profile Templates and an array of Profile Template Numbers field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Number of Activated Profile Templates	M	uint8	1	None	N/A
Profile Template Numbers	C.1	Array of uint8	1 to 14	None	LSO…MSO
MSO ↑					

Table 4.73: IDD Command CP Get Activated Profile Templates Response Operand

C.1: Attached if the Number of Activated Profile Templates field is greater than 0, otherwise excluded.

4.6.2.36 Start Priming

The Operand of the *Start Priming* Op Code is composed of an Amount field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Amount	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.74: IDD Command CP Start Priming Operand

4.6.2.37 Stop Priming

The *Stop Priming* Op Code has no Operand.

4.6.2.38 Set Initial Reservoir Fill Level

The Operand of the *Set Initial Reservoir Fill Level* Op Code is composed of a Fill Level field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Fill Level	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.75: IDD Command CP Set Initial Reservoir Fill Level Operand

4.6.2.39 Reset Reservoir Insulin Operation Time

The *Reset Reservoir Insulin Operation Time Op Code* has no Operand.

4.6.2.40 Read ISF Profile Template

The Operand of the *Read ISF Profile Template* Op Code is composed of an ISF Profile Template Number field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
ISF Profile Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.76: IDD Command CP Read ISF Profile Template Operand

4.6.2.41 Read ISF Profile Template Response

The *Read ISF Profile Template Response* Op Code has no Operand in the context of the IDD Command Control Point, but there is an Operand in the context of the IDD Command Data characteristic, which is defined in the Insulin Delivery Service (see Section 3.8.1.5).

4.6.2.42 Write ISF Profile Template

The Operand of the *Write ISF Profile Template* Op Code could contain up to three time blocks, which are described by their durations in minutes and their insulin sensitivity factors in mg/dL. Depending on the overall number of time blocks and due to the default MTU size, several executions of the Write ISF Profile Template procedure may be required to write the complete ISF profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire ISF profile (i.e., the index of the second time block shall be calculated by adding a value of 1 to that field and a value of 2 shall be added to get the index of the third time block). That field is set to a value in the range of 1 till the maximum number of supported time blocks of the ISF profile template.

The Operand is composed of a Flags field that signals the end of the write transaction and the presence of the fields of the second and third time block within this record, an ISF Profile Template Number field, and a First Time Block Number Index field that represents the index of the following time blocks within the entire ISF profile. The Operand is closed by the fields with the durations and insulin sensitivity factors of the (up to) three time blocks.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
ISF Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
First ISF	M	SFLOAT	2	mg/dL	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second ISF	C.1	SFLOAT	2	mg/dL	LSO…MSO
Third Duration	C.2	uint16	2	minutes	LSO…MSO
Third ISF	C.2	SFLOAT	2	mg/dL	LSO…MSO
MSO ↑					

Table 4.77: IDD Command CP Write ISF Profile Template Operand

C.1:   Attached if bit 1 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 2 of Flags field is set, otherwise excluded.

4.6.2.42.1   Flags field

Bit	Definition	Description
0	End Transaction	If this bit is set, it indicates to the Server that all time blocks of the ISF profile have been sent (i.e., the ISF profile is complete). It shall only be set if the last time blocks of the ISF profile are sent.
1	Second Time Block Present	If this bit is set, the fields Second Duration and Second ISF are present.
2	Third Time Block Present	If this bit is set, the fields Third Duration and Third ISF are present.
All other bits	RFU	None

Table 4.78: Write ISF Profile Template Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.43   Write ISF Profile Template Response

The Operand of the *Write ISF Profile Template Response* Op Code is composed of a Flags field that signals the completion of the write transaction, an ISF Profile Template Number field that is the ISF profile template number of the written ISF profile, and a First Time Block Number Index field that is the offset of the first sent time block of the record within the entire ISF profile.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
ISF Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
MSO ↑					

Table 4.79: IDD Command CP Write ISF Profile Template Response Operand

4.6.2.43.1 Flags field

Bit	Definition	Description
0	Transaction Completed	If this bit is set, the ISF profile passed the plausibility checks of the Server and was written successfully (i.e., the write transaction of all time blocks of the ISF profile completed).
All other bits	RFU	None

Table 4.80: Write ISF Profile Template Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.44 Read I2CHO Ratio Profile Template

The Operand of the *Read I2CHO Ratio Profile Template* Op Code is composed of an I2CHO Ratio Profile Template Number field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
I2CHO Ratio Profile Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.81: IDD Command CP Read I2CHO Ratio Profile Template Operand

4.6.2.45 Read I2CHO Ratio Profile Template Response

The *Read I2CHO Ratio Profile Template Response* Op Code has no Operand in the context of the IDD Command Control Point, but there is an Operand in the context of the IDD Command Data characteristic, which is defined in the Insulin Delivery Service (see Section 3.8.1.6).

4.6.2.46 Write I2CHO Ratio Profile Template

The Operand of the *Write I2CHO Ratio Profile Template* Op Code could contain up to three time blocks, which are described by their durations in minutes and their insulin-to-carbohydrate ratios in grams. Depending on the overall number of time blocks and due to the default MTU size, several executions of the Write I2CHO Ratio Profile Template procedure may be required to write the complete I:CHO ratio profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire I:CHO ratio profile (i.e., the index of the second time block can be calculated by adding a value of 1 to that field and a value of 2 shall be added to get the index of the third time block). That field is set to a value in the range of 1 till the maximum number of supported time blocks of the I:CHO ratio profile template.

The Operand is composed of a Flags field that signals the end of the write transaction and the presence of the fields of the second and third time block within this record, an I2CHO Ratio Profile Template Number field, and a First Time Block Number Index field that represents the index of the following time blocks within the entire I:CHO ratio profile. The Operand is closed by the fields with the durations and insulin-to-carbohydrate ratios of the (up to) three time blocks.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
I2CHO Ratio Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First I2CHO Ratio	M	SFLOAT	2	grams	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second I2CHO Ratio	C.1	SFLOAT	2	grams	LSO…MSO
Third Duration	C.2	uint16	2	minutes	LSO…MSO
Third I2CHO Ratio	C.2	SFLOAT	2	grams	LSO…MSO
MSO ↑					

Table 4.82: IDD Command CP Write I2CHO Ratio Profile Template Operand

C.1: Attached if bit 1 of Flags field is set, otherwise excluded.
C.2: Attached if bit 2 of Flags field is set, otherwise excluded.

4.6.2.46.1   Flags field

Bit	Definition	Description
0	End Transaction	If this bit is set, it indicates to the Server that all time blocks of the I:CHO ratio profile have been sent (i.e., the I:CHO ratio profile is complete). It shall only be set if the last time blocks of the I:CHO ratio profile are sent.
1	Second Time Block Present	If this bit is set, the fields Second Duration and Second I2CHO Ratio are present.
2	Third Time Block Present	If this bit is set, the fields Third Duration and Third I2CHO Ratio are present.
All other bits	RFU	None

Table 4.83: Write I2CHO Ratio Profile Template Operand Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.47   Write I2CHO Ratio Profile Template Response

The Operand of the *Write I2CHO Ratio Profile Template Response* Op Code is composed of a Flags field that signals the completion of the write transaction, an I2CHO Ratio Profile Template Number field that is the I:CHO ratio profile template number of the written I:CHO profile, and a First Time Block Number Index field that is the offset of the first sent time block of the record within the entire I:CHO ratio profile.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
I2CHO Ratio Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
MSO ↑					

Table 4.84: IDD Command CP Write I2CHO Ratio Profile Template Response Operand

4.6.2.47.1 Flags field

Bit	Definition	Description
0	Transaction Completed	If this bit is set, the I:CHO ratio profile passed the plausibility checks of the Server and was written successfully (i.e., the write transaction of all time blocks of the I:CHO ratio profile completed).
All other bits	RFU	None

Table 4.85: Write I2CHO Ratio Profile Template Response Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.48 Read Target Glucose Range Profile Template

The Operand of the *Read Target Glucose Range Profile Template* Op Code is composed of a Target Glucose Range Profile Template Number field:

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Target Glucose Range Profile Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.86: IDD Command CP Read Target Glucose Range Profile Template Operand

4.6.2.49 Read Target Glucose Range Profile Template Response

The *Read Target Glucose Range Profile Template Response* Op Code has no Operand in the context of the IDD Command Control Point, but there is an Operand in the context of the IDD Command Data characteristic, which is defined in the Insulin Delivery Service (see Section 3.8.1.7).

4.6.2.50 Write Target Glucose Range Profile Template

The Operand of the *Write Target Glucose Range Profile Template* Op Code could contain up to two time blocks, which are described by their durations in minutes and their lower and upper target glucose limits in mg/dL. Depending on the overall number of time blocks and due to the default MTU size, several executions of the Write Target Glucose Range Profile Template procedure may be required to write the complete target glucose range profile. Therefore, the First Time Block Number Index field is used to describe the index of the first sent time block of this Operand within the entire target glucose range profile (i.e., the index of the second time block can be calculated by adding a value of 1 to that field). That field is set to a value in the range of 1 till the maximum number of supported time blocks of the target glucose range profile template.

The Operand is composed of a Flags field that signals the end of the write transaction and the presence of the fields of the second time block within this record, a Target Glucose Range Profile Template Number field, and a First Time Block Number Index field that represents the index of the following time

blocks within the entire target glucose range profile. The Operand is closed by the fields with the durations and lower and upper target glucose limits of the (up to) two time blocks.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Target Glucose Range Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
First Duration	M	uint16	2	minutes	LSO…MSO
First Lower Target Glucose Limit	M	SFLOAT	2	mg/dL	LSO…MSO
First Upper Target Glucose Limit	M	SFLOAT	2	mg/dL	LSO…MSO
Second Duration	C.1	uint16	2	minutes	LSO…MSO
Second Lower Target Glucose Limit	C.1	SFLOAT	2	mg/dL	LSO…MSO
Second Upper Target Glucose Limit	C.1	SFLOAT	2	mg/dL	LSO…MSO
MSO ↑					

Table 4.87: IDD Command CP Write Target Glucose Range Profile Template Operand

C.1:   Attached if bit 1 of Flags field is set, otherwise excluded.

4.6.2.50.1   Flags field

Bit	Definition	Description
0	End Transaction	If this bit is set, it indicates to the Server that all time blocks of the target glucose range profile have been sent (i.e., the target glucose range profile is complete). It shall only be set if the last time blocks of the target glucose range profile are sent.
1	Second Time Block Present	If this bit is set, the fields Second Duration, Second Lower Target Glucose Limit, and Second Upper Target Glucose Limit are present.
All other bits	RFU	None

Table 4.88: Write Target Glucose Range Profile Template Operand Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.51 Write Target Glucose Range Profile Template Response

The Operand of the *Write Target Glucose Range Profile Template Response* Op Code is composed of a Flags field that signals the completion of the write transaction, a Target Glucose Range Profile Template Number field that is the target glucose range profile template number of the written target glucose range profile, and a First Time Block Number Index field that is the offset of the first sent time block of the record within the entire target glucose range profile.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Target Glucose Range Profile Template Number	M	uint8	1	None	N/A
First Time Block Number Index	M	uint8	1	None	N/A
MSO ↑					

Table 4.89: IDD Command CP Write Target Glucose Range Profile Template Response Operand

4.6.2.51.1 Flags field

Bit	**Definition**	**Description**
0	Transaction Completed	If this bit is set, the target glucose range profile passed the plausibility checks of the Server and was written successfully (i.e., the write transaction of all time blocks of the target glucose range profile completed).
All other bits	RFU	None

Table 4.90: Write Target Glucose Range Profile Template Response Operand Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.6.2.52 Get Max Bolus Amount

The *Get Max Bolus Amount* Op Code has no Operand.

4.6.2.53 Get Max Bolus Amount Response

The Operand of the *Get Max Bolus Amount Response* Op Code is composed of a Max Bolus Amount field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Max Bolus Amount	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.91: IDD Command CP Get Max Bolus Amount Response Operand

4.6.2.54 Set Max Bolus Amount

The Operand of the Set Max Bolus Amount Op Code is composed of a Max Bolus Amount field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Max Bolus Amount	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.92: IDD Command CP Set Max Bolus Amount Operand

4.7 IDD Command Data

The IDD Command Data characteristic is identified using the UUID «IDD Command Data», as defined in [2].

The IDD Command Data characteristic is a variable length structure comprising of a Response Op Code field and an Operand field from executed procedures of the IDD Command Control Point, an optional E2E-Counter field, and an optional E2E-CRC field.

If a CP procedure of the IDD Command Control Point responds with more than one record, the IDD Command Data characteristic can be notified with each of those records.

The minimum length of the IDD Command Data record is 2 octets and the maximum length is 20 octets.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Response Op Code (see response Op Code Values of IDD Command CP in Table 4.36)	M	Enumeration of uint16	2	None	LSO…MSO
Operand (value defined per Service)	M	Variable	0 to 15	None	LSO…MSO
E2E-Counter	C.1	uint8	1	N/A	N/A
E2E-CRC	C.1	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.93: IDD Command Data Record

C.1:   Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

4.7.1   Response Op Code field

The Response Op Code field contains the corresponding response Op Code of the executed procedure on the IDD Command Control Point (see Section 4.6.1).

4.7.2   Operand field

The structure of the Operand field depends on the executed procedure on the IDD Command Control Point (i.e., the Response Op Code field) and is defined per Service (see Section 3.8.1.3).

4.8   IDD Record Access Control Point

The IDD Record Access Control Point is based on the Record Access Control Point and identified using the Universally Unique Identifier (UUID) «IDD Record Access Control Point», as defined in [2].

This control point is used by the Insulin Delivery Service to provide basic management functionality of the history database of the Insulin Delivery Device including historical data of the insulin therapy, device state changes, and annunciations. This enables functions including counting records, transmitting records, and clearing records based on filter criterion. The filter criterion in the Operand field is defined by the service that references this characteristic, as is the format of a history record and the sequence of transferred history records.

4.9   IDD History Data

The IDD History Data characteristic is identified using the UUID «IDD History Data», as defined in [2].

The IDD History Data characteristic is a variable length structure comprising of an Event Type field, a Sequence Number field, a Relative Offset field, an Event Data field corresponding to the Event Type field, and an optional E2E-CRC field.

If a CP procedure of the IDD Record Access Control Point responds with more than one record, the IDD History Data characteristic can be notified with each of those records.

The minimum length of the IDD History Data record is 8 octets and the maximum length is 20 octets.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Event Type (see Event Type Values in Table 4.95)	M	Enumeration of uint16	2	None	LSO…MSO
Sequence Number	M	uint32	4	None	LSO…MSO
Relative Offset	M	uint16	2	seconds	LSO…MSO
Event Data	M	Variable	0 to 10	None	LSO…MSO
E2E-CRC	C.1	uint16	2	N/A	LSO…MSO
MSO ↑					

Table 4.94: IDD History Data record

C.1:   Mandatory if device supports E2E-Protection (Bit 0 is set in Flags field of IDD Features), otherwise excluded.

Note: A conditional E2E-Counter field is not included in the IDD History Data characteristic because the Sequence Number field contains an ascending counter for the event records (see Section 4.9.2).

4.9.1 Event Type field

The Event Type field contains the type of event that belongs to a history record.

The following values are defined for the Event Type field:

Description	Value	Event Data Section
Reference Time	0x000F	4.9.4.1
Reference Time Base Offset	0x0033	4.9.4.2
Bolus Calculated Part 1 of 2[1]	0x003C	4.9.4.3
Bolus Calculated Part 2 of 2[1]	0x0055	4.9.4.4
Bolus Programmed Part 1 of 2[1]	0x005A	4.9.4.5
Bolus Programmed Part 2 of 2[1]	0x0066	4.9.4.6
Bolus Delivered Part 1 of 2[1]	0x0069	4.9.4.7
Bolus Delivered Part 2 of 2[1]	0x0096	4.9.4.8
Delivered Basal Rate Changed	0x0099	4.9.4.9
TBR Adjustment Started[2]	0x00A5	4.9.4.10
TBR Adjustment Ended[2]	0x00AA	4.9.4.11
TBR Adjustment Changed[2]	0x00C3	4.9.4.12
Profile Template Activated	0x00CC	4.9.4.13
Basal Rate Profile Template Time Block Changed	0x00F0	4.9.4.14
Total Daily Insulin Delivery	0x00FF	4.9.4.15
Therapy Control State Changed	0x0303	4.9.4.16
Operational State Changed	0x030C	4.9.4.17
Reservoir Remaining Amount Changed	0x0330	4.9.4.18
Annunciation Status Changed Part 1 of 2	0x033F	4.9.4.19
Annunciation Status Changed Part 2 of 2	0x0356	4.9.4.20
ISF Profile Template Time Block Changed	0x0359	4.9.4.21
I2CHO Ratio Profile Template Time Block Changed	0x0365	4.9.4.22
Target Glucose Range Profile Template Time Block Changed	0x036A	4.9.4.23
Priming Started	0x0395	4.9.4.24
Priming Done	0x039A	4.9.4.25
Data Corruption	0x03A6	4.9.4.26
Pointer Event	0x03A9	4.9.4.27
Bolus Template Changed Part 1 of 2	0x03C0	4.9.4.28
Bolus Template Changed Part 2 of 2	0x03CF	4.9.4.29
TBR Template Changed	0x03F3	4.9.4.30

Description	Value	Event Data Section
Max Bolus Amount Changed	0x03FC	4.9.4.31
Manufacturer Reserved Hamming Code Value Range[1]	0xF000 – 0xFFF0	N/A
RFU	All not already defined Hamming code values within 0x0000 and 0xFFFF	N/A
Prohibited	All other values	N/A

Table 4.95: Event Type values

[1] The Manufacturer Reserved range of Event Types Values shall be used by manufacturers of Insulin Delivery Devices to define custom events in addition to the already defined values. This value range is based on the private range for code blocks or partitions as defined in [5]. All non-Hamming codes values within this range are prohibited.

4.9.2 Sequence Number

The Sequence Number field contains a unique number for each event to enable storing of events during the entire lifetime of the Insulin Delivery Device.

4.9.3 Relative Offset

The Relative Offset field contains the elapsed time in seconds since the last recorded Reference Time event. If the Relative Offset is 0x0000, the date time was set for the very first time or has been lost.

4.9.4 Event Data

The following chapters describe the structure of the Event Data field depending on the Event Type.

4.9.4.1 Reference Time

The Event Data of the Reference Time event is composed of a Recording Reason field and an absolute time stamp that is referenced by all event types by their Relative Offset field. The absolute time stamp consists of a Date Time field, a Time Zone field, and a DST Offset field.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Recording Reason	M	Enumeration of uint8	1	None	N/A
Date Time[1]	M	Defined in [2]	7	Smallest unit in seconds	Defined in [2]

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Time Zone[2]	M	Defined in [2]	1	Defined in [2]	Defined in [2]
DST Offset[3]	M	Defined in [2]	1	Defined in [2]	Defined in [2]
MSO ↑					

Table 4.96: IDD History Data Reference Time Event

[1] The Date Time field is in the same format and units as the Date Time characteristic as defined in [2].
[2] The Time Zone field is in the same format and units as the Time Zone characteristic as defined in [2].
[3] The DST Offset field is in the same format and units as the DST Offset characteristic as defined in [2].

4.9.4.1.1   Recording Reason field

The Recording Reason field specifies the reason why the Reference Time event was recorded.

4.9.4.1.2   Recording Reason values

The following values are defined for the Recording Reason field of the Reference Time event:

Description	Value	Meaning
Undetermined	0x0F	The reason is undetermined.
Set Date Time	0x33	The date time of the Insulin Delivery Device was changed (i.e., at least one of the fields – Date Time, Time Zone, or DST Offset changed).
Periodic Recording	0x3C	The Reference Time event was recorded periodically (e.g., at each full hour).
Date Time Loss	0x55	The Insulin Delivery Device lost its date time (e.g., due to battery replacement).That is, the date time of the device is set to its default value and the Relative Offset field of the Reference Time event is 0.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.97: Recording Reason values

4.9.4.2   Reference Time Base Offset

The Event Data of the Reference Time Base Offset event is composed of a Recording Reason field and a Base Offset time stamp which is referenced by all event types by their Relative Offset field. The Base Offset time stamp consists of a Base Time field and a Time Offset field.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Recording Reason	M	Enumeration of uint8	1	None	N/A
Base Time[1]	M	Defined in [2]	7	Smallest unit in seconds	Defined in [2]
Time Offset[2]	M	sint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.98: IDD History Data Reference Time Event

[1] The Base Time field is in the same format and units as the Date Time characteristic as defined in [2].

[2] The Time Offset field is in the same format and units as the Time Offset field of the Glucose Measurement characteristic as defined in [2].

4.9.4.2.1 Recording Reason field

The Recording Reason field specifies the reason why the Reference Time Base Offset event was recorded.

4.9.4.2.2 Recording Reason values

The following values are defined for the Recording Reason field of the Reference Time Base Offset event:

Description	Value	Meaning
Undetermined	0x0F	The reason is undetermined.
Set Date Time	0x33	The date time of the Insulin Delivery Device was changed (i.e., at least one of the fields – Base Time or Time Offset changed).
Periodic Recording	0x3C	The Reference Time event was recorded periodically (e.g., at each full hour).
Date Time Loss	0x55	The Insulin Delivery Device lost its date time (e.g., due to battery replacement). That is, the date time of the device is set to its default value and the Relative Offset field of the Reference Time event is 0.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.99: Recording Reason values

4.9.4.3   Bolus Calculated Part 1 of 2

The Event Data of the Bolus Calculated Part 1 of 2 event is composed of fields for the recommended bolus amounts determined by a Bolus Calculator as part of the application of the Insulin Delivery Device.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Recommended Fast Amount Meal	M	SFLOAT	2	IU	LSO… MSO
Recommended Fast Amount Correction	M	SFLOAT	2	IU	LSO… MSO
Recommended Extended Amount Meal	M	SFLOAT	2	IU	LSO… MSO
Recommended Extended Amount Correction	M	SFLOAT	2	IU	LSO… MSO
MSO ↑					

Table 4.100: IDD History Data Bolus Calculated Part 1 of 2 event

4.9.4.4   Bolus Calculated Part 2 of 2

The Event Data of the Bolus Calculated Part 2 of 2 event is composed of fields for the patient's confirmed bolus amounts of a Bolus Calculator as part of the application of the Insulin Delivery Device.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Confirmed Fast Amount Meal	M	SFLOAT	2	IU	LSO…MSO
Confirmed Fast Amount Correction	M	SFLOAT	2	IU	LSO…MSO
Confirmed Extended Amount Meal	M	SFLOAT	2	IU	LSO…MSO
Confirmed Extended Amount Correction	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.101: IDD History Data Bolus Calculated Part 2 of 2 event

4.9.4.5   Bolus Programmed Part 1 of 2

The Event Data of the Bolus Programmed Part 1 of 2 event is composed of the first part of the settings of a programmed bolus.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus ID	M	uint16	2	None	LSO…MSO
Bolus Type	M	Enumeration of uint8	1	None	N/A
Programmed Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Programmed Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Programmed Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.102: IDD History Data Bolus Programmed Part 1 of 2 event

[1] The Programmed Bolus Fast Amount field shall be set to 0 if Bolus Type is set to "Extended".
[2] The Programmed Bolus Extended Amount field shall be set to 0 if Bolus Type is set to "Fast".
[3] The Programmed Bolus Duration field shall be set to 0 if Bolus Type is set to "Fast".

4.9.4.5.1   Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server Application for a programmed bolus.

4.9.4.5.2   Bolus Type values

See Section 4.5.2.6.3.

4.9.4.6   Bolus Programmed Part 2 of 2

The Event Data of the Bolus Programmed Part 2 of 2 event is composed of the second part of the settings of a programmed bolus.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Bolus Delay Time	C.1	uint16	2	minutes	LSO…MSO

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus Template Number	C.2	uint8	1	None	N/A
Bolus Activation Type	C.3	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.103: IDD History Data Bolus Programmed Part 2 of 2 event

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.
C.3:   Attached if bit 2 of Flags field is set, otherwise excluded.

4.9.4.6.1   Flags field

See Section 4.6.2.18.1.

4.9.4.6.2   Bolus Activation Type values

See Section 4.6.2.18.3.

4.9.4.7   Bolus Delivered Part 1 of 2

The Event Data of the Bolus Delivered Part 1 of 2 event is composed of the first part of the information about a delivered bolus.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus ID	M	uint16	2	None	LSO…MSO
Bolus Type	M	Enumeration of uint8	1	None	N/A
Delivered Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Delivered Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Effective Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.104: IDD History Data Bolus Delivered Part 1 of 2 event

[1] The Delivered Bolus Fast Amount field shall be set to 0 if Bolus Type is set to "Extended".
[2] The Delivered Bolus Extended Amount field shall be set to 0 if Bolus Type is set to "Fast".
[3] The Effective Bolus Duration field shall be set to 0 if Bolus Type is set to "Fast".

4.9.4.7.1 Bolus ID field

The Bolus ID field represents a unique identifier as a uint16 data type created by the Server Application for a programmed bolus.

4.9.4.7.2 Bolus Type values

See Section 4.5.2.6.3.

4.9.4.7.3 Delivered Bolus Fast Amount field

The Delivered Bolus Fast Amount field contains the effective delivered fast amount after termination of the bolus delivery.

4.9.4.7.4 Delivered Bolus Extended Amount field

The Delivered Bolus Extended Amount field contains the effective delivered extended amount after termination of the bolus delivery.

4.9.4.7.5 Effective Bolus Duration field

The Effective Bolus Duration field contains the effective duration of an extended or multiwave bolus from the start of the bolus to the termination. This duration shall be set to 0 in case of a fast bolus.

4.9.4.8 Bolus Delivered Part 2 of 2

The Event Data of the Bolus Delivered Part 2 of 2 event is composed of the second part of the information about a delivered bolus.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Bolus Start Time Offset	M	uint32	4	seconds	LSO…MSO
Bolus Activation Type	C.1	Enumeration of uint8	1	None	N/A
Bolus End Reason	C.2	Enumeration of uint8	1	None	N/A
Annunciation Instance ID	C.3	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.105: IDD History Data Bolus Delivered Part 2 of 2 event

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.
C.3:   Attached if bit 2 of Flags field is set, otherwise excluded.

4.9.4.8.1   Flags field

Bit	Definition	Description
0	Bolus Activation Type Present	If this bit is set, the Bolus Activation Type field is present.
1	Bolus End Reason Present	If this bit is set, the Bolus End Reason field is present.
2	Annunciation Instance ID Present	If this bit is set, the Annunciation Instance ID field is present.
All other bits	RFU	None

Table 4.106: Bolus Delivered Part 2 of 2 event Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.8.2   Bolus Start Time Offset field

The Bolus Start Time Offset field describes the start time of the bolus delivery in relative time since the timestamp of the corresponding Bolus Programmed Part 1 of 2 event in seconds (i.e., the Bolus ID fields of these events have the same value).

4.9.4.8.3   Bolus Activation Type values

See Section 4.6.2.18.3.

4.9.4.8.4   Bolus End Reason values

The following values are defined for the Bolus End Reason field:

Description	Value	Meaning
Undetermined	0x0F	The reason why the bolus ended is undetermined.
Programmed Amount Delivered	0x33	The programmed amount was delivered completely.
Canceled	0x3C	The bolus was canceled by an interaction (e.g., by the user via a remote control or the device itself).
Error Abort	0x55	The bolus was aborted due to an error.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.107: Bolus End Reason values

4.9.4.8.5 Annunciation Instance ID field

An annunciation corresponding to this event occurred and this field represents the unique identifier of that annunciation. See Section 4.3.2.

4.9.4.9 Delivered Basal Rate Changed

The Event Data of the Delivered Basal Rate Changed is composed of information about the old basal rate, the new basal rate, and a context of the basal delivery.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Old Basal Rate Value	M	SFLOAT	2	IU/h	LSO…MSO
New Basal Rate Value	M	SFLOAT	2	IU/h	LSO…MSO
Basal Delivery Context	C.1	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.108: IDD History Data Change Basal Rate Event

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.

4.9.4.9.1 Flags field

Bit	Definition	Description
0	Basal Delivery Context Present	If this bit is set, the Basal Delivery Context field is present.
All other bits	RFU	None

Table 4.109: Delivered Basal Rate Changed Event Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.9.2 Old Basal Rate Value field

The Old Basal Rate Value field contains the previous basal rate before the change that triggered the recording of the Delivered Basal Rate Changed event.

4.9.4.9.3 New Basal Rate Value field

The New Basal Rate Value field contains the new basal rate to which the previous one was changed.

4.9.4.9.4 Basal Delivery Context values

See Section 4.5.2.8.3.

4.9.4.10 TBR Adjustment Started

The Event Data of the TBR Adjustment Started event is composed of the settings of a started TBR.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
TBR Type	M	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[1]	M	SFLOAT	2	IU/h or None[1]	LSO…MSO
TBR Duration Programmed	M	uint16	2	minutes	LSO…MSO
TBR Template Number	C.1	uint8	1	None	N/A
MSO ↑					

Table 4.110: IDD History Data TBR Adjustment Started event

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.

[1] If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.9.4.10.1 Flags field

Bit	Definition	Description
0	TBR Template Number Present	If this bit is set, the TBR Template Number field is present.
All other bits	RFU	None

Table 4.111: TBR Adjustment Started Event Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.10.2 TBR Type values

See Section 4.5.2.8.2.

4.9.4.11 TBR Adjustment Ended

The Event Data of the TBR Adjustment Ended event is composed of information about an ended TBR.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Last Set TBR Type	M	Enumeration of uint8	1	None	N/A
Effective TBR Duration	M	uint16	2	minutes	LSO…MSO
TBR End Reason	M	Enumeration of uint8	1	None	N/A
Last Set TBR Template Number	C.1	uint8	1	None	N/A
Annunciation Instance ID	C.2	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.112: IDD History Data TBR Adjustment Ended event

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.
C.2:   Attached if bit 1 of Flags field is set, otherwise excluded.

4.9.4.11.1   Flags field

Bit	Definition	Description
0	Last Set TBR Template Number Present	If this bit is set, the Last Set TBR Template Number field is present.
1	Annunciation Instance ID Present	If this bit is set, the Annunciation Instance ID field is present.
All other bits	RFU	None

Table 4.113: TBR Adjustment Ended Event Flags field

> Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.11.2   Last Set TBR Type values

See Section 4.5.2.8.2.

4.9.4.11.3   Effective TBR Duration field

The Effective TBR Duration field contains the effective duration of the TBR since its start (i.e., since the time stamp of the corresponding TBR Adjustment Started event) until its termination if the programmed duration is over, the TBR is canceled by the user, or it is aborted due to an error.

4.9.4.11.4　TBR End Reason values

The following values are defined for the TBR End Reason field:

Description	Value	Meaning
Undetermined	0x0F	The reason why the TBR ended is undetermined.
Programmed Duration Over	0x33	The programmed duration of the TBR is over.
Canceled	0x3C	The TBR was canceled by an interaction (e.g., by the user via a remote control or the device itself).
Error Abort	0x55	The TBR was aborted due to an error.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.114: TBR End Reason values

4.9.4.11.5　Annunciation Instance ID field

An annunciation corresponding to this event occurred and this field represents the unique identifier of that annunciation. See Section 4.3.2.

4.9.4.12　TBR Adjustment Changed

The Event Data of the TBR Adjustment Changed event is composed of the change settings of a currently active TBR.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
TBR Type	M	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[1]	M	SFLOAT	2	IU/h or None[1]	LSO…MSO
TBR Duration Programmed	M	uint16	2	minutes	LSO…MSO

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Elapsed TBR Duration Since Last Change or Start	M	uint16	2	minutes	LSO…MSO
TBR Template Number	C.1	uint8	1	None	N/A
MSO ↑					

Table 4.115: IDD History Data TBR Adjustment Changed event

C.1:   Attached if bit 0 of Flags field is set, otherwise excluded.

[1] If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.9.4.12.1   Flags field

See Section 4.9.4.10.1.

4.9.4.12.2   TBR Type values

See Section 4.5.2.8.2.

4.9.4.12.3   Elapsed Time Since Last TBR Change or Start field

The Elapsed Time Since Last TBR Change or Start field contains the elapsed time of the TBR from its last change (i.e., since the time stamp of the previous TBR Adjustment Changed event), or if there was no previous change, from its start (i.e., since the time stamp of the corresponding TBR Adjustment Started event) until this change.

4.9.4.13   Profile Template Activated

The Event Data of the Profile Template Activated event is composed of a Profile Template Type field, an Old Profile Template Number field, and a New Profile Template Number field. The old profile template number denotes the previously activated profile template and the new profile template number denotes the currently activated profile template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Profile Template Type	M	uint8	1	None	N/A
Old Profile Template Number[1]	M	uint8	1	None	N/A
New Profile Template Number	M	uint8	1	None	N/A
MSO ↑					

Table 4.116: IDD History Data Profile Template Activated event

[1] If a profile template was not activated previously, the value of the Old Profile Template Number is set to 0.

4.9.4.13.1   Profile Template Type values

The following values are defined for the Profile Template Type field:

Description	Value
Undetermined	0x0F
Basal Rate Profile Template	0x33
ISF Profile Template	0x3C
I2CHO Ratio Profile Template	0x55
Target Glucose Range Profile Template	0x5A
RFU	All not already defined Hamming code values within 0x00 and 0xFF
Prohibited	All other values

Table 4.117: Profile Template Type values

4.9.4.14   Basal Rate Profile Template Time Block Changed

The Event Data of the Basal Rate Profile Template Time Block Changed event is composed of a Basal Rate Profile Template Number field that contains the Template Number of the changed Basal Rate Profile Template, and a Time Block Number field that represents the number of the time block within the entire basal rate profile. The event is closed by the fields with the duration and amount of the time block. The Time Block Number field is set to a value in the range of 1 till the maximum number of supported time blocks of the basal rate profile template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Basal Rate Profile Template Number	M	uint8	1	None	N/A
Time Block Number	M	uint8	1	None	N/A
Duration	M	uint16	2	minutes	LSO…MSO
Rate	M	SFLOAT	2	IU/h	LSO…MSO
MSO ↑					

Table 4.118: IDD History Data Basal Rate Profile Template Time Block Changed event

4.9.4.15   Total Daily Insulin Delivery

The Event Data of the Total Daily Insulin Delivery event is composed of a Flags field, a Total Daily Insulin Sum of Bolus Delivered field with the sum of the delivered bolus insulin amount, and a Total Daily Insulin Sum of Basal Delivered field containing the sum of the delivered basal insulin amount. It is closed by the Year, Month, and Day fields that describe the day this event was recorded for.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Total Daily Insulin Sum of Bolus Delivered[1]	M	SFLOAT	2	IU	LSO…MSO
Total Daily Insulin Sum of Basal Delivered[2]	M	SFLOAT	2	IU	LSO…MSO
Year[3]	M	Defined in [2]	2	Smallest unit in years	Defined in [2]
Month[4]	M	Defined in [2]	1	Smallest unit in months	Defined in [2]
Day[5]	M	Defined in [2]	1	Smallest unit in days	Defined in [2]
MSO ↑					

Table 4.119: IDD History Data Total Daily Insulin Delivery event

[1] The Total Daily Insulin Sum of Bolus Delivered field shall be set to 0 if the Insulin Delivery Device does not support a basal rate (Bit 1 is not set in Flags field of IDD Features).

2 The Total Daily Insulin Sum of Basal Delivered field shall be set to 0 if the Insulin Delivery Device does not support boluses (Bits 5, 6 and 7 are not set in Flags field of IDD Features).

3 The Year field is in the same format and has the same units as the Year field of the Date Time characteristic, as defined in [2].

4 The Month field is in the same format and has the same units as the Month field of the Date Time characteristic, as defined in [2].

5 The Day field is in the same format and has the same units as the Day field of the Date Time characteristic, as defined in [2].

4.9.4.15.1 Flags field

Bit	Definition	Description
0	Date Time Changed Warning	If this bit is set, the date time of the Insulin Delivery Device will have changed since the last recorded Total Daily Insulin Delivery Event.
All other bits	RFU	None

Table 4.120: Total Daily Insulin Delivery Event Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.16 Therapy Control State Changed

The Event Data of the Therapy Control State Changed event is composed of a Therapy Control State field that describes the therapy control state of the Insulin Delivery Device at the time this event is recorded.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Old Therapy Control State	M	Enumeration of uint8	1	None	N/A
New Therapy Control State	M	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.121: IDD History Data Therapy Control State Changed event

4.9.4.16.1 Therapy Control State values

See Section 4.2.1.1.

4.9.4.17 Operational State Changed

The Event Data of the Operational State Changed event is composed of an Operational State field that describes the operational state of the Insulin Delivery Device at the time this event was recorded.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Old Operational State	M	Enumeration of uint8	1	None	N/A
New Operational State	M	Enumeration of uint8	1	None	N/A
MSO ↑					

Table 4.122: IDD History Data Operational State Changed event

4.9.4.17.1　Operational State values

See Section 4.2.2.1.

4.9.4.18　Reservoir Remaining Amount Changed

The Event Data of the Reservoir Remaining Amount Changed event is composed of a Reservoir Remaining Amount field that describes the remaining insulin amount in the reservoir at the time this event was recorded.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Reservoir Remaining Amount	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.123: IDD History Data Reservoir Remaining Amount Changed Event

4.9.4.19　Annunciation Status Changed Part 1 of 2

The Event Data of the Annunciation Status Changed Part 1 of 2 event is composed of a Flags field, an Annunciation Instance ID field, an Annunciation Type field, an Annunciation Status field, and optional AuxInfo1 and AuxInfo2 fields.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
Annunciation Instance ID	M	uint16	2	None	LSO…MSO
Annunciation Type	M	Enumeration of uint16	2	None	LSO…MSO
Annunciation Status	M	Enumeration of uint8	1	None	N/A

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
AuxInfo1	C.1	Binary Object	2	None	LSO…MSO
AuxInfo2	C.1	Binary Object	2	None	LSO…MSO
MSO ↑					

Table 4.124: IDD History Data Annunciation Status Changed Part 1 of 2 event

C.1:   Mandatory if field is indicated via Flags field, otherwise excluded.

4.9.4.19.1   Flags field

Bit	Definition	Description
0	AuxInfo1 Present	If this bit is set, the AuxInfo1 field is present.
1	AuxInfo2 Present	If this bit is set, the AuxInfo2 field is present.
All other bits	RFU	None

Table 4.125: IDD History Data Annunciation Status Changed Part 1 of 2 event Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.19.2   Annunciation Instance ID field

See Section 4.3.2.

4.9.4.19.3   Annunciation Type field

See Section 4.3.3.

4.9.4.19.4   Annunciation Type values

See Section 4.3.3.1.

4.9.4.19.5   Annunciation Status field

The Annunciation Status field represents the work status of an annunciation.

4.9.4.19.6   Annunciation Status values

See Section 4.3.5.

4.9.4.19.7   AuxInfo1 and AuxInfo2 field

The AuxInfo1 field is the first and the AuxInfo2 field the second of the (up to) five auxiliary information fields of an annunciation that describe details of the annunciation (also see Section 4.3.6). The Annunciation Status Changed Part 2 of 2 event contains the other three AuxInfo fields.

4.9.4.20   Annunciation Status Changed Part 2 of 2

The Event Data of the Annunciation Status Changed Part 2 of 2 event is composed of a Flags field and up to three of the five auxiliary information fields of an annunciation that describe annunciation details (also see Section 4.3.6). The IDD Annunciation Status Changed Part 1 of 2 event contains the first two AuxInfo fields.

LSO ↓					
	Requirement	Data Type	Size (octets)	Unit	Byte Order
Flags	M	8 bit	1	None	N/A
AuxInfo3	C.1	Binary Object	2	None	LSO…MSO
AuxInfo4	C.1	Binary Object	2	None	LSO…MSO
AuxInfo5	C.1	Binary Object	2	None	LSO…MSO
MSO ↑					

Table 4.126: IDD History Data Annunciation Status Changed Part 2 of 2 event

C.1:   Mandatory if field is indicated via Flags field, otherwise excluded.

4.9.4.20.1   Flags field

Bit	Definition	Description
0	AuxInfo3 Present	If this bit is set, the AuxInfo3 field is present.
1	AuxInfo4 Present	If this bit is set, the AuxInfo4 field is present.
2	AuxInfo5 Present	If this bit is set, the AuxInfo5 field is present.
All other bits	RFU	None

Table 4.127: Annunciation Status Changed Part 2 of 2 event Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.21   ISF Profile Template Time Block Changed

The Event Data of the ISF Profile Template Time Block Changed event is composed of an ISF Profile Template Number field that contains the Template Number of the changed ISF Profile Template, and a Time Block Number field that represents the number of the time block within the entire ISF profile. The event is closed by the fields with the duration and ISF of the time block. The Time Block Number field is set to a value in the range of 1 till the maximum number of supported time blocks of the ISF profile template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
ISF Profile Template Number	M	uint8	1	None	N/A
Time Block Number	M	uint8	1	None	N/A
Duration	M	uint16	2	minutes	LSO…MSO
ISF	M	SFLOAT	2	mg/dL	LSO…MSO
MSO ↑					

Table 4.128: IDD History Data ISF Profile Template Time Block Changed Event

4.9.4.22   I2CHO Ratio Profile Template Time Block Changed

The Event Data of the Change I2CHO Ratio Profile Template Time Block event is composed of an I2CHO Ratio Profile Template Number field that contains the Template Number of the changed I:CHO Ratio Profile Template, and a Time Block Number field that represents the number of the time block within the entire I:CHO ratio profile. The event is closed by the fields with the duration and I:CHO ratio of the time block. The Time Block Number field is set to a value in the range of 1 till the maximum number of supported time blocks of the I:CHO ratio profile template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
I2CHO Ratio Profile Template Number	M	uint8	1	None	N/A
Time Block Number	M	uint8	1	None	N/A
Duration	M	uint16	2	minutes	LSO…MSO
I2CHO Ratio	M	SFLOAT	2	grams	LSO…MSO
MSO ↑					

Table 4.129: IDD History Data Change I2CHO Ratio Profile Template Time Block Changed Event

4.9.4.23   Target Glucose Range Profile Template Time Block Changed

The Event Data of the Target Glucose Range Profile Template Time Block event is composed of a Target Glucose Profile Template Number field that contains the Template Number of the changed Target Glucose Range Profile Template, and a Time Block Number field that represents the number of the time block within the entire target glucose range profile. The event is closed by the fields with the duration and lower and upper target glucose limits of the time block. The Time Block Number field is set to a value in

the range of 1 till the maximum number of supported time blocks of the target glucose range profile template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Target Glucose Range Profile Template Number	M	uint8	1	None	N/A
Time Block Number	M	uint8	1	None	N/A
Duration	M	uint16	2	minutes	LSO…MSO
Lower Target Glucose Limit	M	SFLOAT	2	mg/dL	LSO…MSO
Upper Target Glucose Limit	M	SFLOAT	2	mg/dL	LSO…MSO
MSO ↑					

Table 4.130: IDD History Data Change Target Glucose Profile Template Time Block Changed event

4.9.4.24 Priming Started

The Event Data of the Priming Started event is composed of a Programmed Amount field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Programmed Amount	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.131: IDD History Data Priming Started event

4.9.4.24.1 Programmed Amount field

The Programmed Amount field contains the programmed amount of the priming in IU.

4.9.4.25   Priming Done

The Event Data of the Priming Done event is composed of a Flags field, a Delivered Amount field, and a Reason of Termination field. It is closed by an optional Annunciation Instance ID field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Delivered Amount	M	SFLOAT	2	IU	LSO…MSO
Reason of Termination	M	Enumeration of uint8	1	None	N/A
Annunciation Instance ID	C.1	uint16	2	None	LSO…MSO
MSO ↑					

Table 4.132: IDD History Data Priming Done event

C.1:   Mandatory if field is indicated via Flags field, otherwise excluded.

4.9.4.25.1   Flags field

Bit	Definition	Description
0	Annunciation Instance ID Present	If this bit is set, the Annunciation Instance ID field is present.
All other bits	RFU	None

Table 4.133: Priming Done Event Flags field

Note: The bits in the table above are defined as: 0 = False and 1 = True

4.9.4.25.2   Delivered Amount field

The Delivered Amount field contains the delivered amount of the programmed amount since the start of the priming in IU.

4.9.4.25.3   Reason of Termination field

The Recording of Termination field specifies the reason why the Priming Done event was recorded.

4.9.4.25.4   Reason of Termination values

The following values are defined for the Reason of Termination field:

Description	Value	Meaning
Undetermined	0x0F	The termination reason of the priming is undetermined.
Aborted by User	0x33	The user aborted the priming of the Insulin Delivery Device (i.e., procedure Stop Priming was executed or the priming was aborted directly on the Insulin Delivery Device).
Programmed Amount Reached	0x3C	The priming volume of the programmed amount provided by the Start Priming procedure was reached.
Error Abort	0x55	The priming was aborted due to an error.
RFU	All not already defined Hamming code values within 0x00 and 0xFF	All values in this table which are not defined above and do match a Hamming code value in the range of 0x00 and 0xFF are reserved for future use.
Prohibited	All other values	All values not defined above are prohibited.

Table 4.134: Reason of Termination Values

4.9.4.25.5   Annunciation Instance ID field

An annunciation occurred during priming and stopped the priming procedure (e.g., Mechanical Issue), and this field represents the unique identifier of that annunciation. See Section 4.3.2.

4.9.4.26   Data Corruption

The Data Corruption event has no Event Data.

4.9.4.27   Pointer Event

The Pointer Event has no Event Data.

4.9.4.28   Bolus Template Changed Part 1 of 2

The Event Data of the Bolus Template Changed Part 1 of 2 event is composed of the first part of the settings of a changed bolus template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Bolus Template Number	M	uint8	1	None	N/A
Bolus Type	M	Enumeration of uint8	1	None	N/A
Bolus Fast Amount[1]	M	SFLOAT	2	IU	LSO…MSO
Bolus Extended Amount[2]	M	SFLOAT	2	IU	LSO…MSO
Bolus Duration[3]	M	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.135: IDD History Data Bolus Template Changed Part 1 of 2 event

[1] The Bolus Fast Amount field shall be set to 0 if Bolus Type is set to "Extended".
[2] The Bolus Extended Amount field shall be set to 0 if Bolus Type is set to "Fast".
[3] The Bolus Duration field shall be set to 0 if Bolus Type is set to "Fast".

4.9.4.28.1 Bolus Type values

See Section 4.5.2.6.3.

4.9.4.29 Bolus Template Changed Part 2 of 2

The Event Data of the Bolus Template Changed Part 2 of 2 event is composed of the second part of the settings of a changed bolus template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Flags	M	8 bit	1	None	N/A
Bolus Delay Time	C.1	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.136: IDD History Data Bolus Template Changed Part 2 of 2 event

C.1:   Mandatory if field is indicated via Flags field, otherwise excluded.

4.9.4.29.1 Flags field

See Section 4.6.2.25.1.

4.9.4.30 TBR Template Changed

The Event Data of the TBR Template Changed event is composed of the settings of a changed TBR template.

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
TBR Template Number	M	uint8	1	None	N/A
TBR Type	M	Enumeration of uint8	1	None	N/A
TBR Adjustment Value[1]	M	SFLOAT	2	IU/h or None[1]	LSO…MSO
TBR Duration	M	uint16	2	minutes	LSO…MSO
MSO ↑					

Table 4.137: IDD History Data TBR Template Changed event

[1] If the TBR is absolute (i.e., TBR Type is set to "Absolute"), the TBR Adjustment Value field contains the temporary basal rate as the absolute value in IU/h. If the TBR is relative (i.e., TBR Type is set to "Relative"), the TBR Adjustment Value field contains a dimensionless scaling factor.

4.9.4.30.1 TBR Type values

See Section 4.5.2.8.2.

4.9.4.31 Max Bolus Amount Changed

The Event Data of the Max Bolus Amount Changed event is composed of an Old Max Bolus Amount field and a New Max Bolus Amount field:

LSO ↓					
	Requirement	**Data Type**	**Size (octets)**	**Unit**	**Byte Order**
Old Max Bolus Amount	M	SFLOAT	2	IU	LSO…MSO
New Max Bolus Amount	M	SFLOAT	2	IU	LSO…MSO
MSO ↑					

Table 4.138: IDD History Data Max Bolus Amount Changed event

5 Implementation notes

Sensor and Collector Applications for Insulin Delivery Devices must implement functional safety. A method designed to achieve this is the use of Hamming codes for enumerations. In an effort to minimize possible bit errors (e.g., caused by electromagnetic fields) during the transcoding of enumerations from non-Hamming to Hamming code representations, all enumerations included in the characteristics are already defined with a Hamming distance of 4 bits. The gaps between the Hamming code values are prohibited and shall not be used. Furthermore, the value of 0 is skipped to provide that an initialization of a value was really done. With the Hamming distance of 4 bits there can be 15 different Hamming code values within *0x00* and *0xFF* and 2047 different Hamming code values within *0x0000* and *0xFFFF*.

Enumerations that represent response codes have a Hamming distance of 4 bits between the response code of success and the codes describing errors. For instance, the Hamming distance between the error codes is defined as 1 bit to get a maximum utilization while ensuring at the same time a high safety due to the greater Hamming distance to the success code.

The CP Op Codes are defined with Hamming distances across all control points of the service, because the control points are accessed by the Server and Client application via handles (provided by the Bluetooth Stack) and it cannot be assumed that these handles have a Hamming distance. For each control point in the context of the Insulin Delivery Service, a range of CP Op Code values is reserved to allow future extensions with consecutive numbering.

All enumerations contain a value of "Undetermined" except in the cases where an enumeration is only used in an Operand of a procedure to provide a consistent definition and to simplify the implementation of the Server (e.g., initialization).

The following list shows Hamming code values in the range of *0x0000* and *0xFFFF* that shall be used within this service:

Hamming Code #	Hamming Code Value	
0001	0x000F	0000 0000 0000 1111
0002	0x0033	0000 0000 0011 0011
0003	0x003C	0000 0000 0011 1100
0004	0x0055	0000 0000 0101 0101
0005	0x005A	0000 0000 0101 1010
0006	0x0066	0000 0000 0110 0110
0007	0x0069	0000 0000 0110 1001
0008	0x0096	0000 0000 1001 0110
0009	0x0099	0000 0000 1001 1001
0010	0x00A5	0000 0000 1010 0101
0011	0x00AA	0000 0000 1010 1010
0012	0x00C3	0000 0000 1100 0011
0013	0x00CC	0000 0000 1100 1100

Hamming Code #	Hamming Code Value	
0014	0x00F0	0000 0000 1111 0000
0015	0x00FF	0000 0000 1111 1111
0016	0x0303	0000 0011 0000 0011
0017	0x030C	0000 0011 0000 1100
0018	0x0330	0000 0011 0011 0000
0019	0x033F	0000 0011 0011 1111
0020	0x0356	0000 0011 0101 0110
0021	0x0359	0000 0011 0101 1001
0022	0x0365	0000 0011 0110 0101
0023	0x036A	0000 0011 0110 1010
0024	0x0395	0000 0011 1001 0101
0025	0x039A	0000 0011 1001 1010
0026	0x03A6	0000 0011 1010 0110
0027	0x03A9	0000 0011 1010 1001
0028	0x03C0	0000 0011 1100 0000
0029	0x03CF	0000 0011 1100 1111
0030	0x03F3	0000 0011 1111 0011
…	…	….
2040	0xFF96	1111 1111 1001 0110
2041	0xFF99	1111 1111 1001 1001
2042	0xFFA5	1111 1111 1010 0101
2043	0xFFAA	1111 1111 1010 1010
2044	0xFFC3	1111 1111 1100 0011
2045	0xFFCC	1111 1111 1100 1100
2046	0xFFF0	1111 1111 1111 0000
2047	0xFFFF	1111 1111 1111 1111

Table 5.1: Hamming Codes Values with distance of 4 within 0x0000 and 0xFFFF

6 Acronyms and abbreviations

Any abbreviation or acronym used in the document, but not defined in the common specification sections (e.g., Volume 1 Part B), is defined here. The list is alphabetized.

Abbreviation or Acronym	Meaning
AP	Artificial Pancreas
APDS	Artificial Pancreas Device System
BOB	Bolus On Board
CGM	Continuous Glucose Monitor
CRC	Cyclic Redundancy Check
DST	Daylight Saving Time
E2E	End to End
I2CHO Ratio I:CHO Ratio	Insulin-to-Carbohydrate Ratio
IDD	Insulin Delivery Device
IDS	Insulin Delivery Service
IOB	Insulin On Board
ISF	Insulin Sensitivity Factor
IU (a.k.a I.U., U, Units)	International Units Unit of measurement for the delivered amount of insulin. IU is not part of the International System of Units. To avoid misinterpreting "I" in "IU" as "1" (One), "Units" or "U" is also common.
IU/h	International Unit per hour
IU/mL	International Unit per milliliter
mg/dL	Milligram per deciliter
NaN	Not a Number
RACP	Record Access Control Point
SFLOAT	16-bit word comprising of a signed 4-bit integer exponent followed by a signed 12-bit mantissa, each in two's-complement form as defined in [3].
TBR	Temporary Basal Rate
UI	User Interface
UUID	Universally Unique Identifier

Table 6.1: Abbreviations and acronyms

7 Glossary

Term	Meaning
Absolute Temporary Basal Rate	A temporary basal rate on a basis of absolute IUs (e.g., 2 IU/h next 30 minutes). Also see *Temporary Basal Rate*.
Active Basal Rate	A basal rate that is currently being used for insulin delivery. Also see *Basal Rate*.
Active Bolus	A bolus that has not been completely delivered. This includes a bolus programmed with a delay time. Also see *Bolus Delay Time*.
Activated Profile Template	A profile template (e.g., basal rate profile template) that has been activated on the Insulin Delivery Device or via a Client. Also see *Profile Template*. Note: If a profile template is activated, it does not necessarily mean that its settings become active almost immediately (e.g., an active basal rate, also see *Active Basal Rate*). The Sensor Application may define further conditions for an activated profile template before making it active (e.g., the Therapy Control State has to be in the "run" state, also see *Therapy Control State*).
Artificial Pancreas Device System	"APDSs link a [Continuous Glucose Monitor (CGM)] to an insulin pump and automatically reduce or increase insulin infusion based upon specified thresholds of measured interstitial glucose. The APDS parts are designed to communicate with each other to automate the process of maintaining blood glucose concentrations at or near a specified target or range and minimize the incidence and severity of hypoglycemic (dangerously low blood sugar) and hyperglycemic (dangerously high blood sugar) events." [4]
Basal Rate	The amount of insulin that is required to cover the patient's basal, meal-independent insulin needs throughout the day (e.g., 0.6 IU per hour between 9:00 am and 2:00 pm).
Basal Profile (a.k.a. Basal Rate Profile)	If a basal rate is programmed in time blocks (e.g., hourly basal rates), the series of all time blocks is called a basal profile. Each time block describes a duration and an insulin amount. The time blocks of a basal rate profile are in a chronological order starting from midnight. The sum of the durations of the time blocks shall be 24 h (i.e., the basal profile covers a full day from midnight to midnight). Different basal profiles meet the patient's changing insulin needs (e.g., during the week rather than on the weekend).
Bolus	The amount of insulin delivered (independent of the basal rate) to cover the intake of food (meal bolus) and to correct high blood glucose levels (correction bolus). The accumulated amounts of a meal bolus and a correction bolus could also be delivered as a single bolus.

Term	Meaning
Bolus Calculator (a.k.a. Bolus Wizard)	Part of an Insulin Delivery Sensor or Collector Application to calculate the dose for the next bolus and recommend it for delivery. This dose could consist of two parts: a meal amount and a correction amount. The meal amount is determined by the patient's estimated carbohydrates for the intake of food and the correction amount is determined by the patient's current blood glucose level. In addition, the already delivered insulin and the patient's insulin sensitivity could be considered in the calculation.
Bolus Delay Time (a.k.a. Bolus Lag Time or Bolus Lag Setting)	The bolus delay time specifies a delay between programming a bolus and the actual delivery of the bolus. This setting is helpful for patients with delayed digestion (gastroparesis).
Client Application	The higher layer application on a GATT Client.
Collector Application	The higher layer application on a Collector.
Enumeration	Data type consisting of a set of named values.
Extended Bolus (a.k.a. Slow Bolus)	An extended Bolus delivers the programmed insulin dose over a specific period of time (e.g., 1 IU for the next 30 min). This bolus type can be helpful for meals that are slowly digestible, for example, foods with complex carbohydrates or foods that are high in fat.
Fast Bolus (a.k.a. Immediate Bolus)	The fast bolus delivers the programmed insulin dose all at once (e.g., 1 IU). This bolus is suitable for meals that contain mainly fast digestible carbohydrates as well as for the correction of high blood glucose levels.
I:CHO Ratio Profile (a.k.a. I2CHO Ratio Profile used for Characteristic field names)	If an I:CHO ratio is programmed in time blocks (e.g., hourly I:CHO ratios), the series of all time blocks is called an I:CHO ratio profile. Each time block describes a duration and an I:CHO Ratio. The time blocks of an I:CHO ratio profile are in a chronological order starting from midnight. The sum of the durations of the time blocks shall be 24 hours (i.e., the I:CHO ratio profile covers a full day from midnight to midnight).
Infusion Set	Tubing system with cannula that interfaces the insulin reservoir to the body.
Insulin	A hormone that helps cells transform glucose into energy. Insulin is produced in the beta cells of the pancreas (also called islets of Langerhans).
Insulin On Board (a.k.a. Bolus On Board (BOB) or Active Insulin)	The amount of bolus insulin that was previously delivered but is still active in the body.
Insulin Sensitivity Factor (a.k.a. Correction Factor)	Defines the expected decrease in blood glucose from 1 IU of insulin. It is necessary to know the blood glucose lowering effect of the insulin being given in order to determine an appropriate insulin dose.
Insulin-to-Carbohydrate Ratio	The I:CHO Ratio defines the number of CHOs (grams) covered by 1 IU of insulin.

Term	Meaning
ISF Profile	If an ISF is programmed in time blocks (e.g., hourly ISFs), the series of all time blocks is called an ISF profile. Each time block describes a duration and an ISF. The time blocks of an ISF profile are in a chronological order starting from midnight. The sum of the durations of the time blocks shall be 24 h (i.e., the ISF profile covers a full day from midnight to midnight).
Maximum Bolus Amount	The maximum bolus amount is a safety feature that limits the amount of insulin that can be delivered in a single bolus. Note: It includes both the fast and extended amounts of a single bolus. See also *Bolus*.
Multiwave Bolus	The multiwave bolus combines a fast bolus with an extended bolus; one part of the bolus amount is delivered immediately (see *Fast Bolus*), while the other is delivered over a specific period of time (see *Extended Bolus*). This bolus is suitable for meals that contain both fast and slowly digestible carbohydrates or long meals with several courses.
Operational State	The operational state represents the operational state of the Insulin Delivery Device in the context of running an insulin infusion therapy (e.g., priming).
Priming	Filling of the fluidic path from the reservoir to the body with insulin (e.g., after replacement of the reservoir and/or infusion set).
Profile Template	A profile template is a template of a series of time blocks that define a specific therapy setting for a duration of 24 h from midnight to midnight (e.g., *Basal Rate Profile*) and a subset of templates (see *Template*).
Relative Temporary Basal Rate	Temporary basal rate on a percentage basis (e.g., 125% for the next 30 min = TBR Adjustment Value of 1.25 for the next 30 min) relative to the basal rate profile. Also see *Temporary Basal Rate*.
Reservoir	The insulin supply of an Insulin Delivery Device.
Rewinding	The insulin pump rewinds the piston rod to enable the insertion of a new reservoir (related to insulin pumps with cartridge).
Server Application	The higher layer application on a GATT Server.
Sensor Application	The higher layer application on a Sensor that instantiates GATT Services.
Sniffing	The insulin pump detects the position of the plunger in the reservoir (related to insulin pumps with cartridge).
Template	Templates define a specific profile (e.g., basal rate profile), TBR, or bolus (e.g., the user could define different basal profiles for workdays and the weekend). If the Server application supports several templates, the user may select the template that shall be applied. Also see *Profile Template*.
Temporary Basal Rate	A temporary increase or decrease of the current basal rate profile to match changing insulin needs due to increased or decreased activity level, illness, or stress. Also see *Basal Rate*.

Term	Meaning
Therapy Control State	The therapy control state describes the therapy state of the insulin delivery (e.g., stop, pause, run).
Time Block	Contains a specific therapy setting (e.g., *Basal Rate*) to be applied for a specific duration. Time blocks are used in series to define a profile (e.g., *Basal Rate Profile*).
Transaction	In the context of the Insulin Delivery Service, a transaction is a sequence of CP procedures of the same Op Code and ends with the indication of the last CP procedure. That last CP procedure is identified by the End of Transaction flag.

Table 7.1: Glossary

8 References

[1] Bluetooth Core Specification Version 4.2 or later

[2] Bluetooth Assigned Numbers, https://www.bluetooth.com/specifications/assigned-numbers/

[3] IEEE Std 11073-20601™ - 2008 Health Informatics - Personal Health Device Communication - Application Profile - Optimized Exchange Protocol - version 1.0 or later, Annex A, Short floating point data type

[4] Guidance for Industry and Food and Drug Administration Staff - The Content of Investigational Device Exemption (IDE) and Premarket Approval (PMA) Applications for Artificial Pancreas Device Systems - November 9, 2012

[5] IEEE Std 11073-10101™ - 2004 Health Informatics - Point-of-care medical device communication – Nomenclature

[6] GATT Specification Supplement (GSS), https://www.bluetooth.com/specifications/gss/

Appendix A Examples of AuxInfo fields

Below are examples showing the usage of the AuxInfo fields of the IDD Annunciation Status characteristic (see Section 3.4). The AuxInfo fields can be used by a manufacturer of an Insulin Delivery Device to describe details of an annunciation (i.e., the underlying data and data format of these fields are defined by the Server Application). Table A.1 and Table A.2 show examples of an Annunciation Type used with different AuxInfo values. If the size of a value of an AuxInfo field is less than the predefined size of 2 octets, a padding (e.g., 0x00) should be used. If on the other hand the size of a value is greater than the size of one AuxInfo field, several AuxInfo fields can be spanned.

Annunciation Type	AuxInfo Field	AuxInfo Value1	Size (octets)2	Byte Order2
Bolus Canceled	AuxInfo1	Bolus ID	2	LSO…MSO
	AuxInfo2	Bolus Type	1	LSO…MSO
		0x00 (padding)	1	
	AuxInfo3	Programmed Bolus Fast and Extended Amount [IU; SFLOAT]	2	LSO…MSO
	AuxInfo4	Delivered Bolus Fast and Extended Amount [IU; SFLOAT]	2	LSO…MSO
	AuxInfo5	Effective Bolus Duration [minutes; uint16]	2	LSO…MSO

Table A.1: Example A for Usage of AuxInfo fields

Annunciation Type	AuxInfo Field	AuxInfo Value1	Size (octets)2	Byte Order2
Bolus Canceled	AuxInfo1	Delivered Bolus Fast and Extended Amount [IU; FLOAT]	4	LSO…MSO
	AuxInfo2			LSO…MSO
	AuxInfo3	Effective Bolus Duration [minutes; uint16]	2	LSO…MSO
	AuxInfo4	Bolus ID	2	LSO…MSO
	AuxInfo5	N/A	2	LSO…MSO

Table A.2: Example B for Usage of AuxInfo fields

[1] The value of the AuxInfo field and unit depend on the specific implementation.

[2] The size and byte order of the AuxInfo fields are predetermined by the IDD Annunciation Status characteristic as defined in [2].

Appendix B Examples of accessing a basal rate profile

The following chapters show examples of reading and writing a basal rate profile.

Table B.1 shows an example of a basal rate profile with five time blocks that is used in Figure B.1 and

 to illustrate the reading and writing sequences of this profile, defined as Basal Rate Profile Template 1.

Time Block #	Duration [min]	Rate [IU/h]
1	180	1.0
2	330	1.5
3	345	2.0
4	345	0.5
5	240	1.0

Table B.1: Example of a basal rate profile with five time blocks

B.1 Reading a basal rate profile

Figure B.1 shows an example of a basal rate profile reading sequence with values from Table B.1, defined as Basal Rate Profile Template 1.
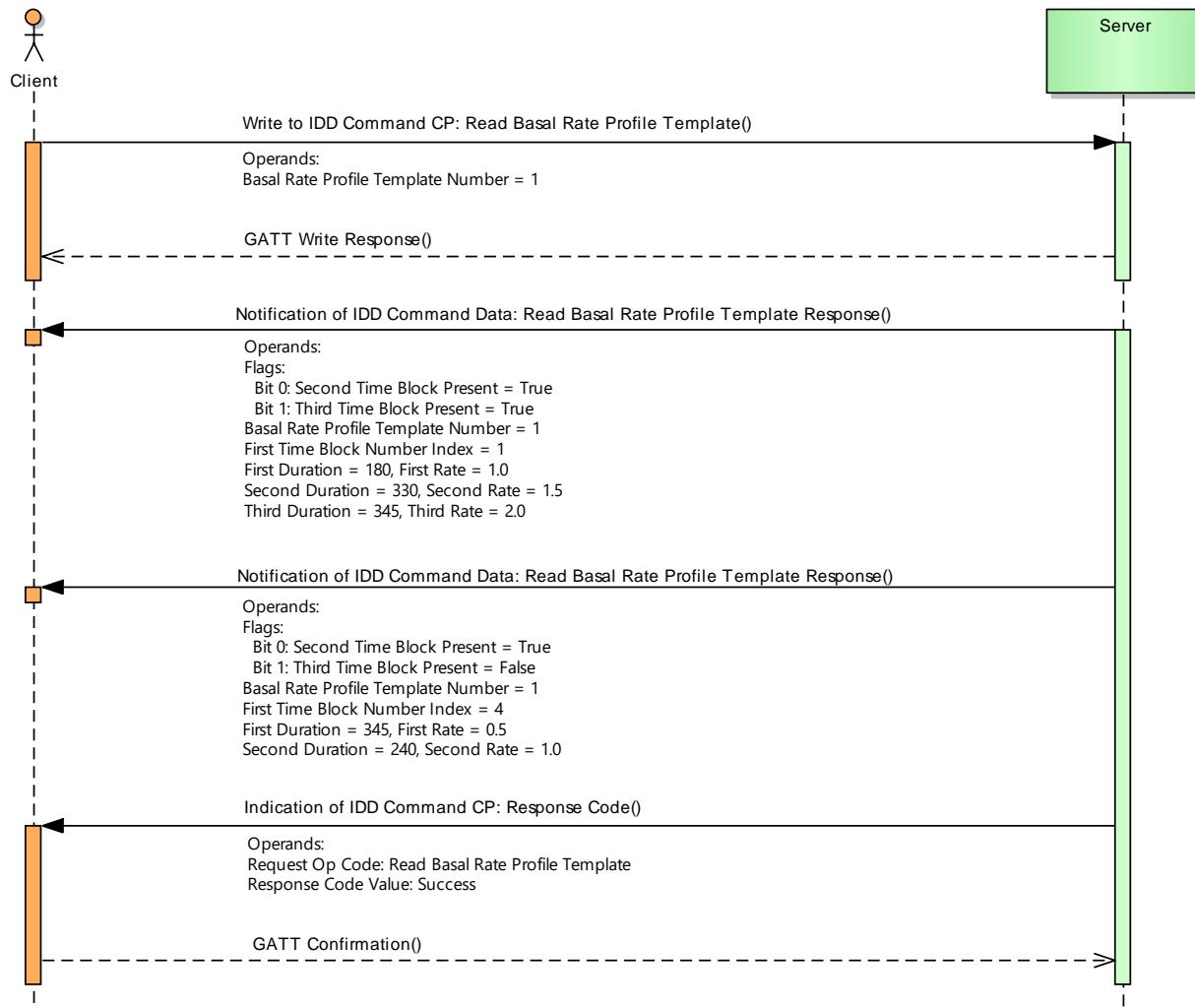
Figure B.1: Example of reading a basal rate profile with values from Table B.1

B.2   Writing a basal rate profile

Figure B.2 shows an example of a basal rate profile writing sequence with values from Table B.1, defined as Basal Rate Profile Template 1.
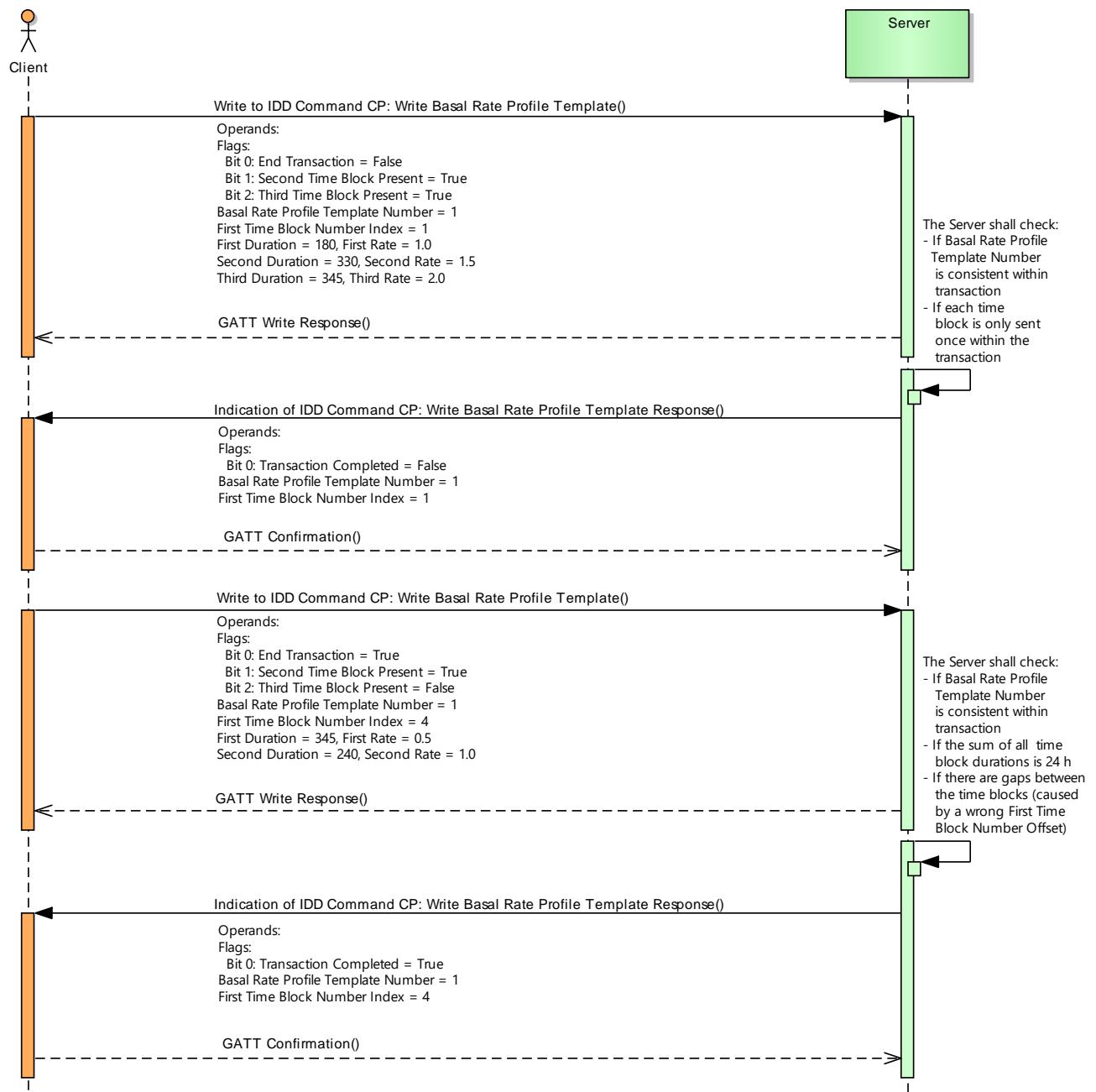
Figure B.2: Example of writing a basal rate profile with values from Table B.1

Appendix C   Example of getting template status and details

Table C.1 shows an example of a basal rate profile and ISF profile template status and details, and Figure C.1 depicts getting template status and details for all supported template types. In this case, two template types are supported; a basal rate profile template type and an ISF profile template type. The basal rate profile template numbers range from 1 to 3 inclusively and the ISF profile template numbers range from 4 to 5. Both template types allow for a maximum number of 24 time blocks. The configurable and configured status of a template is defined by an array of flags. Only configured templates can be read, applied, or reset by the Client, and only configurable templates can be written by the Client. See Sections 3.7.2.17 and 3.8.1.8 for additional details.

Template Type	Starting Template Number	Number of Templates	Max Number of Supported Time Blocks	Configurable	Configured
Basal Rate Profile Template	1	3	24	[Yes, No, Yes]	[No, Yes, Yes]
ISF Profile Template	4	2	24	[Yes, Yes]	[No, No]

Table C.1: Example of template details for basal rate and ISF profile template types
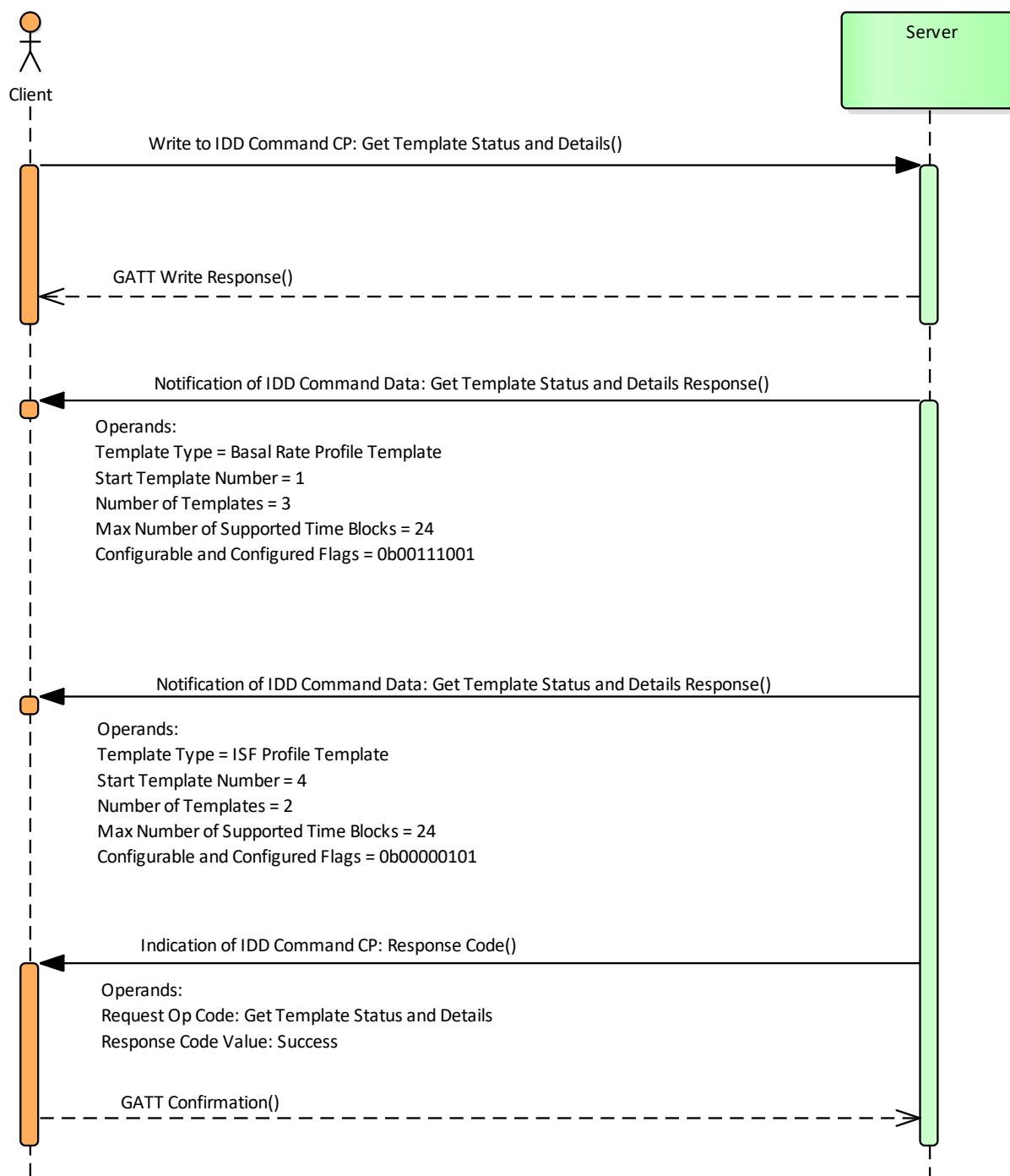
Figure C.1: Example of getting the template status and details with values from Table C.1

Appendix D Examples of recorded events

The following chapters show examples of recorded events that can be retrieved by Clients.

D.1   Setting of the Date Time

Table D.1 shows the recording of two date time settings (represented by Reference Time events) and two bolus deliveries. The first Reference Time event is the very first event in the history, and the second is recorded because the user changed the date time.

Event Type	Sequence Number	Relative Offset	Event Data	Calculated Time Stamp[1]
Reference Time	0	0	Recording Reason: Set Date Time 2014-01-01, 12:00:00 PM	2014-01-01, **12:00:00 PM**
...	…	…	…	…
Bolus Delivered Part 1 of 2	5	30	Bolus ID = 1 …	2014-01-01, **12:00:30 PM** = *12:00:00 PM* + 30 s
…	…	…	...	…
Reference Time	10	3600	Recording Reason: Set Date Time 2014-01-01,11:00:00 AM	2014-01-01, **01:00:00 PM** = *12:00:00 PM* + 3600 s
Bolus Delivered Part 1 of 2	11	10	Bolus ID = 2 …	2014-01-01, **11:00:10 AM** = *11:00:00 AM* + 10 s
…	…	…	…	…

Table D.1: Example of recording the Setting of the Date Time

[1] The absolute time stamp of a single event can be calculated by a Client by using the previous Reference Time event.

The following figure shows an event histogram that might be created by a Server or Client Application based on the history table above:

- 0: Initial Time Change to 2014-01-01, 12:00:00 PM
- 5: Bolus Delivery at 2014-01-01, 12:00:30 PM
- 10: Time Change to 2014-01-01, 11:00:00 AM at 2014-01-01, 01:00:00 PM
- 11: Bolus Delivery at 2014-01-01, 11:00:10 AM (3580 s after previous delivery)[1]

Time line of events (ordered by Sequence Number)
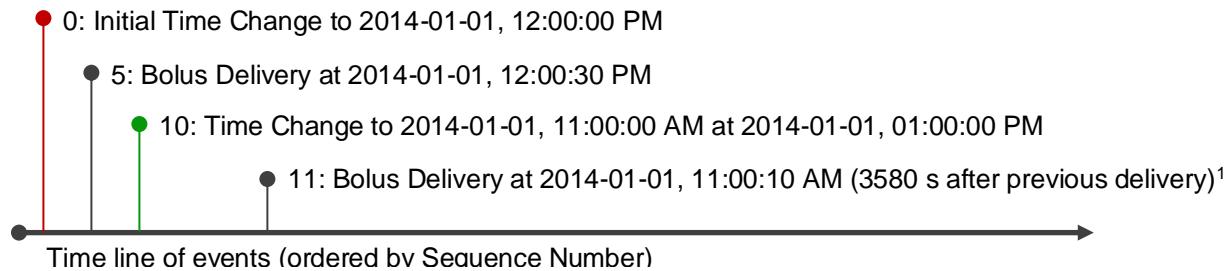
Figure D.1: Exemplary Application Event Histogram corresponding to Table D.1

[1] An application can calculate the interval between two therapy events in case of a time change:
3580 s = 3600 s + 10 s – 30 s

D.2   Date Time Loss

Table D.2 shows the recording of two date time settings (represented by Reference Time events) and two annunciations. The first Reference Time event is recorded due to a date time loss (i.e., the device sets its default date time), and the second one is recorded because the user set the correct date time.

Event Type	Sequence Number	Relative Offset	Event Data	Calculated Time Stamp[1]
...	…	…	…	…
Reference Time	99	0	Recording Reason: Date Time Loss 2005-01-01, 12:00:00 AM	2005-01-01, **12:00:00 AM**
...	…	…	…	…
Annunciation Status Changed Part 1 of 2	110	30	…	2005-01-01, **12:00:30 AM** = *12:00:00 AM* + 30 s
…	…	…	...	…
Reference Time	120	7638	Recording Reason: Set Date Time 2014-01-01, 11:00:00 AM	2005-01-01, **02:07:18 AM** = *12:00:00 AM* + 7638 s
Annunciation Status Changed Part 1 of 2	121	10	…	2014-01-01, **11:00:10 AM** = *11:00:00 AM* + 10 s
…	…	…	…	…

Table D.2: Example of recording a Date Time Loss

[1] The absolute time stamp of a single event can be calculated by a Client by using the previous Reference Time event.

The following figure shows an event histogram that might be created by a Server or Client Application based on the history table above:

- ● 99: Date Time Lost
- ● 110: Annunciation Status Changed at 2005-01-01, 12:00:30 AM
- ● 120: Time Change to 2014-01-01, 11:00:00 AM
- ● 121: Annunciation Status Changed at 2014-01-01, 11:00:10 AM
  (7618 s after previous annunciation)[1]

Time line of events (ordered by Sequence Number)
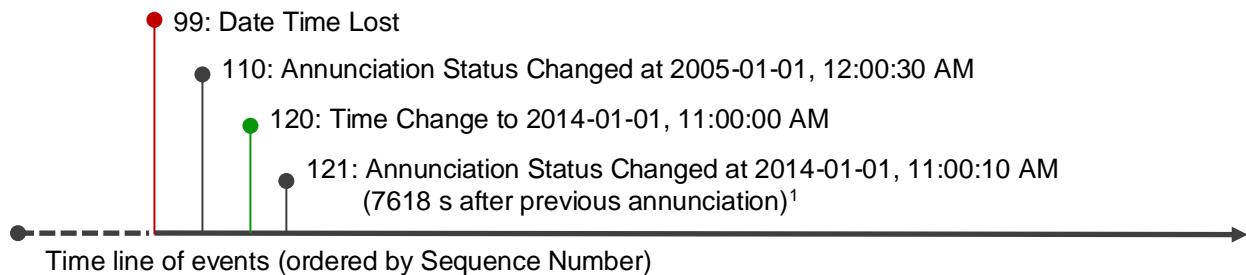
Figure D.2: Exemplary Application Event Histogram corresponding to Table D.2

[1] An application can recalculate the absolute time when the date time was lost if the Insulin Delivery Device is able to determine the Relative Offset of the new Reference Time event:
08:52:42 AM = 11:00:00 PM – 7638 s

D.3 Bolus programming and delivery

Table D.3 shows the recording of a bolus programming and its delivery that is handled by compound event groups (see Section 3.10.1). It means that the Bolus Programmed and Bolus Delivered Events are each recorded in two parts. Both event parts are recorded with a Sequence Number increased by 1 and same Relative Offset field value.

The first event in this example is a periodically recorded Reference Time event (Sequence Number 5). After that, the user programmed a multiwave bolus with a duration of 2 minutes and a bolus delay time of 1 minute (Bolus Programmed Part 1 and 2, Sequence Number 10 and 11). Two minutes later, another periodical Reference Time event (Sequence Number 50) is recorded. Finally, three minutes after the programming of the multiwave bolus, its extended part is delivered completely (Bolus Delivered Part 1 and 2, Sequence Number 51 and 52).

The delivery of the bolus in this example was started one minute after its programming, and this time stamp can be calculated by using the time stamp of the corresponding Bolus Programmed Part 1 of 2 event (i.e., programming and delivery events have the same Bolus ID field values) and adding the Bolus Start Time Offset field value of the Bolus Delivered Part 2 of 2 event:

12:59:00 PM = 12:58:00 PM + 60 s

> Note: The delay of the delivery of a bolus does not match the programmed bolus delay time in all cases. For example, the Insulin Delivery Device may be set to Therapy Control State "Stop" due to a mechanical issue and be set to "Run" again after that issue is solved.

Event Type	Sequence Number	Relative Offset	Event Data	Calculated Time Stamp[1]
Reference Time	5	3600	Recording Reason: Periodic Recording 2014-01-01, 12:00:00 PM	2014-01-01, 12:00:00 PM
...	…	…	…	…
Bolus Programmed Part 1 of 2	10	3480	Bolus ID = 1 Bolus Type = Multiwave Programmed Bolus Duration = 2 min …	2014-01-01 **12:58:00 PM** = *12:00:00 PM* + 3480 s
Bolus Programmed Part 2 of 2	11	3480	Flags: Bolus Delay Time = 1 min …	2014-01-01 **12:58:00 PM** = *12:00:00 PM* + 3480 s
…	…	…	...	…
Reference Time	50	3600	Recording Reason: Periodic Recording 2014-01-01, 01:00:00 PM	2014-01-01, **01:00:00 PM** = *12:00:00 PM* + 3600 s
Bolus Delivered Part 1 of 2	51	60	Bolus ID = 1 Bolus Type = Multiwave Effective Bolus Duration = 2 min …	2014-01-01, **01:01:00 PM** = *01:00:00 PM* + 60 s
Bolus Delivered Part 2 of 2	52	60	Bolus Start Time Offset = 60 s …	2014-01-01, **01:01:00 PM** = *01:00:00 PM* + 60 s

Table D.3: Example of recording a bolus programming and delivery

[1] The absolute time stamp of a single event can be calculated by a Client by using the previous Reference Time event.

D.4 TBR adjustment

Table D.4 shows the recording of a TBR adjustment that is handled by compound event groups (see Section 3.10.1). It means that the TBR Adjustment Started, TBR Adjustment Changed, and TBR Adjustment Ended events are each recorded with a subsequent Delivered Basal Rate Changed event with a Sequence Number increased by 1 and same Relative Offset field value.

The first event in this example is a periodically recorded Reference Time event (at 12:00:00 PM). After that, the user started a relative TBR at 12:01:00 PM with a factor of 1.1 and a duration of 30 min (TBR Adjustment Started event, Sequence No 10). This means that the Insulin Delivery Device adjusted the basal rate from 10 IU/h to 11 IU/h (Delivered Basal Rate Changed event, Sequence No 11).

Then the user changed the settings of the active TBR (i.e., the settings of the currently active TBR are overwritten completely) at 12:02:00 PM by increasing the factor from 1.1 to 1.2 and keeping the programmed duration of 30 minutes (TBR Adjustment Changed event, Sequence No 15). This changed the current Basal Rate from 11 IU/h to 12 IU/h (Delivered Basal Rate Changed event, Sequence No 16). The elapsed time from the start of the TBR until its change is one minute.

Finally, the changed TBR is over after 30 minutes at 12:32:00 PM (TBR Adjustment Ended event, Sequence No 20) and the initial basal rate of 10 IU/h before the TBR is restored (Delivered Basal Rate Changed event, Sequence No 21). The settings of the changed TBR had been effective for 30 min until the programmed duration was over.

The complete TBR from its start at 12:01:00 PM, its change at 12:02:00 PM, and until its end at 12:32:00 PM had a duration of 31 minutes.

Event Type	Sequence Number	Relative Offset	Event Data
Reference Time	5	3600	Recording Reason: Periodic Recording 2014-01-01, 12:00:00 PM
TBR Adjustment Started	10	60	Flags Bit 0: TBR Template Number Present = false TBR Type = Relative TBR Adjustment Value = 1.1 TBR Duration Programmed = 30 [min]
Delivered Basal Rate Changed	11	60	Flags: Bit 0: Sum Of Basal Delivered and Basal Delivery Context Present = false Old Basal Rate Value = 10 [IU/h] New Basal Rate Value = 11 [IU/h]
TBR Adjustment Changed	15	120	Flags Bit 0: TBR Template Number Present = false TBR Type = Relative TBR Adjustment Value = 1.2 TBR Duration Programmed = 30 [min] Elapsed Time Since Last TBR Change or Start = 1 [min]
Delivered Basal Rate Changed	16	120	Flags: Bit 0: Sum Of Basal Delivered and Basal Delivery Context Present = false Old Basal Rate Value = 11 [IU/h] New Basal Rate Value = 12 [IU/h]
TBR Adjustment Ended	20	1920	Flags: Bit 0: Last Set TBR Template Number Present = false Last Set TBR Type = Relative Effective TBR Duration = 31 [min] TBR End Reason = Programmed Duration Over
Delivered Basal Rate Changed	21	1920	Flags: Bit 0: Sum Of Basal Delivered and Basal Delivery Context Present = false Old Basal Rate Value = 12 [IU/h] New Basal Rate Value = 10 [IU/h]

Table D.4: Example of recording a TBR adjustment

D.5   Change of Basal Rate Profile Template

Table D.5 shows the recording of a change of a basal rate profile template that is handled as a compound event group (see Section 3.10.1). It means that the full profile shall be recorded as a sequence of Change Basal Rate Time Blocks events and the durations of these time blocks shall be 24 h. In addition, the events are recorded with a Sequence Number increased by 1 and the same Relative Offset field value.

The recorded basal rate profile is the example from Section Appendix B with 5 time blocks. The first event is a periodically Reference Time event. After that, the sequence of Change Basal Rate Profile Time Block events are recorded.

Event Type	Sequence Number	Relative Offset	Event Data
Reference Time	5	3600	Recording Reason: Periodic Recording 2014-01-01, 12:00:00 PM
Basal Rate Profile Template Time Block Changed	10	30	Basal Rate Profile Template Number = 1 Time Block Number = 1 Duration = 180 [min] Amount = 1.0 [IU/h]
Basal Rate Profile Template Time Block Changed	11	30	Basal Rate Profile Template Number = 1 Time Block Number = 2 Duration = 330 [min] Amount = 1.5 [IU/h]
Basal Rate Profile Template Time Block Changed	12	30	Basal Rate Profile Template Number = 1 Time Block Number = 3 Duration = 345 [min] Amount = 2.0 [IU/h]
Basal Rate Profile Template Time Block Changed	13	30	Basal Rate Profile Template Number = 1 Time Block Number = 4 Duration = 345 [min] Amount = 0.5 [IU/h]
Basal Rate Profile Template Time Block Changed	14	30	Basal Rate Profile Template Number = 1 Time Block Number = 5 Duration = 240 [min] Amount = 1.0 [IU/h]

Table D.5: Example of recording the Change of a Basal Rate Profile Template

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